[Volume IV, Appx00881 – Appx02292]

Nos. 22-2069, -2070, -2071, -2072

IN THE

United States Court of Appeals

FOR THE FEDERAL CIRCUIT

MASIMO CORPORATION,

Appellant,

v.

APPLE INC.,

Appellee.

APPEAL FROM THE PATENT TRIAL AND APPEAL BOARD
CASE NOS. IPR2021-00193, IPR2021-00195, IPR2021-00208, IPR2021-00209

JOINT APPENDIX

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Paper 32
Date: June 1, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00208
Patent 10,258,266 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges.*

KINDER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition (Paper 2, "Pet.") pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of claims 1–6, 8–16, 18, and 19 ("challenged claims") of U.S. Patent No. 10,258,266 B1 (Ex. 1001, "the '266 patent"). We instituted the petitioned review (Paper 7).

Masimo Corporation ("Patent Owner") filed a Patent Owner Response (Paper 15, "PO Resp.") to oppose the Petition. Petitioner filed a Reply (Paper 18, "Pet. Reply") to the Patent Owner Response. Patent Owner filed a Sur-reply (Paper 22, "Sur-reply") to the Reply. We conducted an oral hearing on March 15, 2022. A transcript has been entered into the record (Paper 31, "Tr.").

We have jurisdiction under 35 U.S.C. § 6(b)(4) and § 318(a). This Decision is a final written decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 as to the patentability of claims 1–6, 8–16, 18, and 19 of the '266 patent. We determine Petitioner has shown by a preponderance of the evidence that those claims are unpatentable.

B. Related Matters

The parties identify the following matters related to the '266 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00193 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,299,708 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00195 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,190 B1); and

Apple Inc. v. Masimo Corporation, IPR2021-00209 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,191 B1).

Pet. 1, 72–73;[1] Paper 3, 1, 3–4.

Patent Owner further identifies certain issued patent applications, as well as other pending and abandoned applications, that claim priority to, or share a priority claim with, the ’266 patent. Paper 3, 1–3.

C. The ’266 Patent

The ’266 patent is titled “Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents,” and issued on April 16, 2019, from U.S. Patent Application No. 16/212,537, filed December 6, 2018. Ex. 1001, codes (21), (22), (45), (54). The ’266 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/086,060, 61/086,108, 61/086,063, and 61/086,057, each filed on August 4, 2008, as well as 61/091,732 filed on

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[1] Petitioner lists “U.S. Patent[] 10,299,708 (IPR2020-00193)” as a related *inter partes* review petition. Pet. 73. The case number associated with Patent No. 10,299,708 B1 is IPR2021-00193 and not “IPR2020-00193” as listed by Petitioner.

Case: 22-2069 Document: 21-4 Page: 181 Filed: 05/01/2023

August 25, 2008, and 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The '266 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:31–33. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:22–28, 55–58. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:35–41.

Figure 1 of the '266 patent is reproduced below.

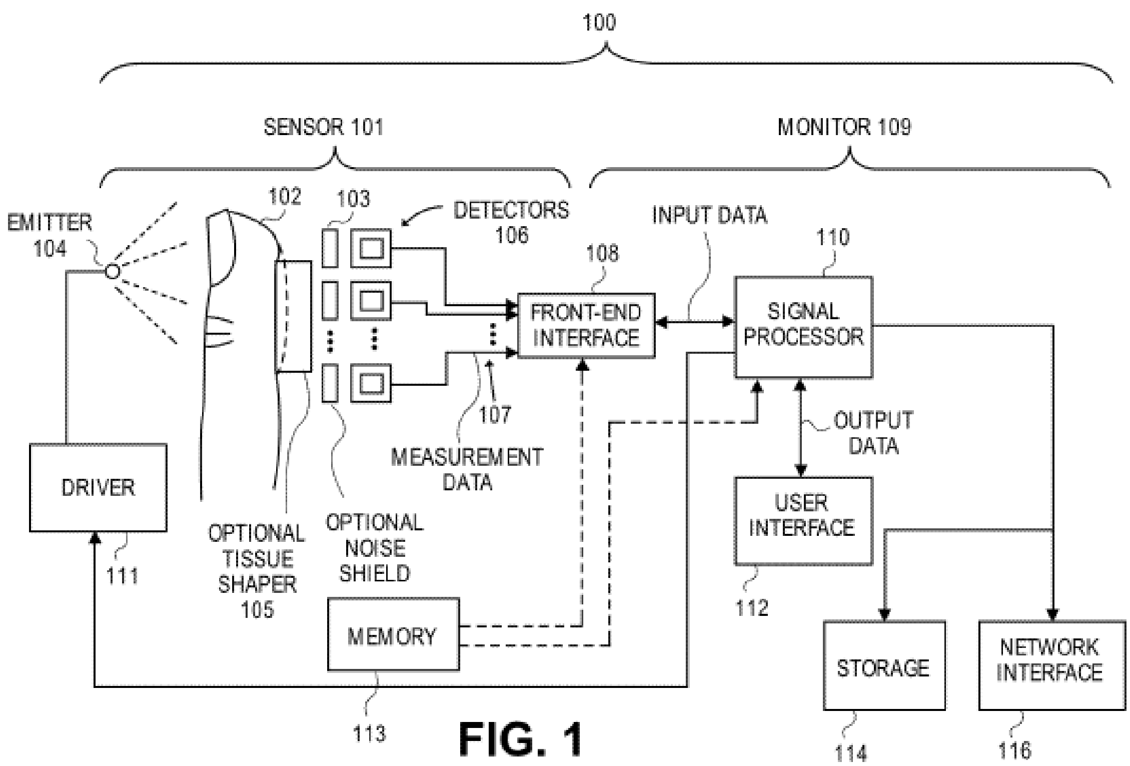

FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:36–38. Sensor 101 includes emitter 104 and detectors 106. *Id.* at 11:48–50. Emitter 104 emits light that is attenuated or reflected by the patient's tissue at measurement site 102. *Id.*

at 13:61–64. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signal 107 to monitor 109 through front-end interface 108. *Id.* at 14:16–22. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:59–11:3.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:6–8. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors 106." *Id.* at 15:12–15. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:38–42. In response to user input or device orientation, user interface 112 can "reorient its display indicia." *Id.* at 15:44–48. The monitor may include storage device 114 and network interface 116. *Id.* at 15:52–54. In some embodiments, the monitor, including the display, is attached to the patient by a strap. *Id.* at 17:64–67.

The '266 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

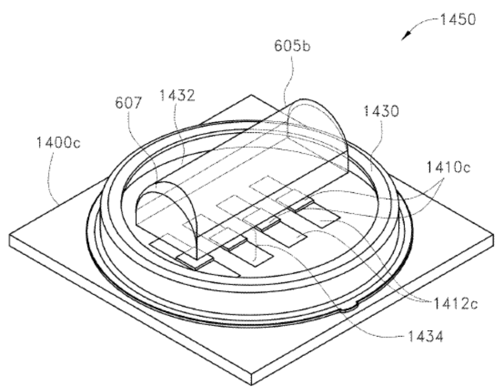

FIG. 14D

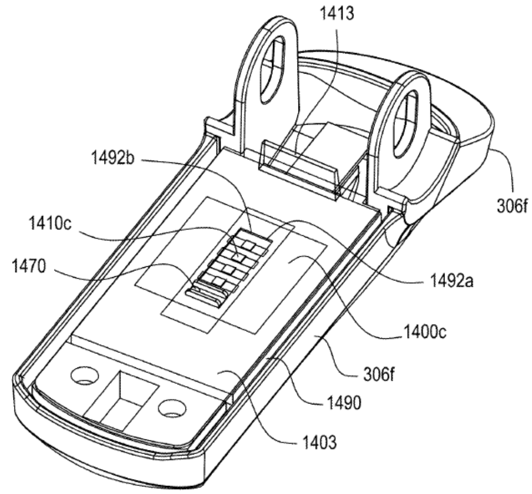

FIG. 14F

Figure 14D illustrates a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:34–37. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b is disposed. *Id.* at 36:17–24. Figure 14F illustrates detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 36:63–64. In some embodiments, the detector shell includes walls to separate individual photodiode arrays and to "prevent or reduce mixing of light signals." *Id.* at 22:28–31. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* at 36:65–37:8.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

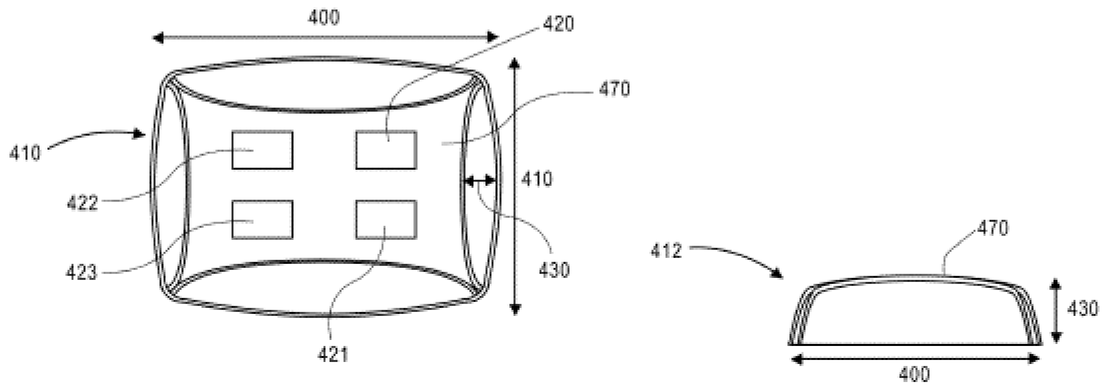

FIG. 4A FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement site contact area 470. *Id.* at 23:8–14. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, the measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:31–33. The measurement site contact area includes windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:39–53.

D. Illustrative Claim

Of the challenged claims, claims 1 and 9 are independent. Claim 1 is illustrative and is reproduced below.

> 1. A noninvasive optical physiological sensor comprising:
>
> [a] a plurality of emitters configured to emit light into tissue of a user;
>
> [b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors;
>
> [c] a housing configured to house at least the plurality of detectors; and
>
> [d] a lens configured to be located between the tissue of the user and the plurality of detectors when the noninvasive

> optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor worn by the user and during operation of the noninvasive optical physiological sensor.

Ex. 1001, 44:36–54 (bracketed lettering [a]–[d] added). Independent claim 9 includes limitations similar to limitations [a]–[d] of claim 1, and also includes additional recitations. *Id.* at 45:13–23 (additionally reciting "a lens forming a cover," "a circular housing including a planar surface" and a "grid pattern").

E. Applied References

Petitioner relies upon the following references:

> Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");
>
> Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");
>
> Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[2] and
>
> Y. Mendelson, et al., "Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Association for the Advancement of Medical Instrumentation, Vol. 22, No. 4, 167–173 (1988) (Ex. 1015, "Mendelson-1988").

Pet. 2.

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[2] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). Ex. 1008, 24. In this Decision, we also refer to the translation.

Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003), and the Second Declaration of Thomas W. Kenny (Ex. 1047). Patent Owner submits, *inter alia*, the Declaration of Vijay K. Madisetti, Ph.D. (Ex. 2004). The parties also provide deposition testimony from Dr. Kenny and Dr. Madisetti, including from this and other proceedings. *See* Exs. 1034–1036, 2006–2009, 2020, 2027.

F. Asserted Grounds

Petitioner asserts that claims 1–6, 8–16, 18, and 19 are unpatentable based upon the following grounds (Pet. 2):[3]

Claims Challenged	35 U.S.C. §	References/Basis
1–6, 8–16, 18, and 19	103	Aizawa, Inokawa
1–6, 8–16, 18, and 19	103	Aizawa, Inokawa, Ohsaki
1–6, 8–16, 18, and 19	103	Mendelson-1988, Inokawa

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R.

[3] In a section titled "Challenge," Petitioner asserts, *inter alia*, that claims 17, 18, and 29 are unpatentable over 35 U.S.C. § 103 based on the combination of Mendelson-1988, Inokawa, Mendelson-2006 and Beyer. Pet. 1–2. However, Mendelson-2006 and Beyer are not listed as exhibits in the Petition (*see id.* at ii–iii), were not produced into the record as evidence, and Petitioner does not present any arguments regarding the patentability of claims 17, 18, and 29 over these references. The alleged ground challenging claims 17, 18, and 29 based on Mendelson-1988, Inokawa, Mendelson-2006 and Beyer is not part of the Petition and claims 17 and 29 are not addressed in this Decision.

§ 42.100(b) (2019). Although both parties contend that no claim term requires express construction (Pet. 3–4; PO Resp. 10), the substance of the parties' briefing demonstrates that there is a dispute regarding the claim term "cover," which appears in independent claim 9.

1. "cover"

Independent claim 9 requires "a lens forming a cover of the circular housing." Ex. 1001, 45:21. Although independent claim 1 also recites "a lens," it does not recite a "cover." *Id.* at 44:37–54.

Patent Owner argues that the claimed "cover" excludes "an optically clear adhesive/epoxy" and a "resin on a surface." PO Resp. 52. According to Patent Owner, "the '266 Patent distinguishes a resin on a surface from a cover, explaining: 'the cylindrical housing 1430 (and transparent cover 1432) . . . can protect the detectors 1410c and conductors 1412c ***more effectively*** than currently-available ***resin epoxies***.'" *Id.* (quoting Ex. 1001, 36:37–46).

Patent Owner alleges that Dr. Kenny also "distinguished a sealing resin from a cover, acknowledging a 'layer of sealing resin' is 'one way to protect the components ***without using a cover***.'" *Id.* at 52–53 (quoting Ex. 2009, 395:22–396:17). Patent Owner argues its understanding is consistent with the prior art cited by Petitioner. *Id.* at 53 (citing Ex. 1008 ¶ 103, Fig. 17; Ex. 1023 ¶ 35; Ex. 2004 ¶¶ 113–115).

Petitioner replies that "there is nothing in the specification or the prosecution history [of the '266 patent] that would lead a [person of ordinary skill in the art] to conclude that 'cover' should be interpreted based on anything other than its plain meaning." Pet. Reply 24 (citing *Thorner v. Sony Computer Entertainment America LLC*, 669 F.3d 1362, 1368 (Fed. Cir.

2012)). That plain meaning, according to Petitioner, is that "a cover is merely 'something that protects, shelters, or guards.'" *Id.* (quoting Ex. 1050; Ex. 1047 ¶ 48). Petitioner argues that Patent Owner's reliance on the '266 patent Specification takes text out of context and, when context is considered, it is clear that "the epoxy resin to which the '266 patent compares its cover is not [an] epoxy cover . . . but rather epoxy that is applied to solder joints." *Id.* at 24–25 (citing Ex. 1001, 36:50–59; Ex. 1047 ¶ 50).

Petitioner also contends that Patent Owner "mischaracterizes Dr. Kenny's deposition testimony to say he agreed that 'sealing resin' is somehow distinguished from a cover." *Id.* at 24. Petitioner contends that Dr. Kenny simply "clarified that using a sealing resin is 'a pretty common way to protect electronic components.'" *Id.* (citing Ex. 2009, 395:22–396:17; Ex. 1047 ¶ 49). Moreover, Petitioner contends that "such extrinsic evidence would not justify departure from plain meaning under *Thorner*." *Id.*

In its Sur-reply, Patent Owner maintains that the '266 patent "specifically ***distinguishes*** a 'resin' on a surface from a 'cover,'" and Petitioner's opposing reading is not persuasive. PO Sur-reply 20–21.

Upon review of the record, we disagree with Patent Owner's limiting construction of "cover" to exclude epoxy and resin. The plain and ordinary meaning of the term does not support Patent Owner's view. A "cover" ordinarily connotes "something that protects, shelters, or guards." Ex. 1050 (*Merriam-Webster's Collegiate Dictionary*, 11th ed. (©2005)), 288. That plain and ordinary meaning is consistent with the '266 patent's description of "flex circuit cover 360, which can be made of plastic or another suitable material . . . [and] can cover and thereby protect a flex circuit (not shown)."

Ex. 1001, 22:63–65. It also is consistent with the '266 patent's description and illustration of "transparent cover 1432" in Figure 14D, which covers and protects detectors 1410c and conductors 1412c, and which "can be fabricated from glass or plastic, *among other materials*." *See id.* at 36:30–42 (emphasis added), Figs. 14D–14E.

This is not the situation in which a special definition for a claim term has been set forth in the specification with reasonable clarity, deliberateness, and precision, so as to give notice of the inventor's own lexicography. *See Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1370 (Fed. Cir. 2005); *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Nor do we discern that Patent Owner "demonstrate[d] an intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." *Teleflex, Inc. v. Ficosa North America Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002).

Here, based upon our review of the intrinsic evidence, no such special definition or express disavowal of the term "cover" to exclude epoxy and resin exists. Patent Owner relies on the following description of Figure 14D in that regard:

> *In certain embodiments, the cylindrical housing 1430 (and transparent cover 1432)* forms an airtight or substantially airtight or hermetic seal with the submount 1400c. As a result, the cylindrical housing 1430 can protect the detectors 1410c and conductors 1412c from fluids and vapors that can cause corrosion. Advantageously, *in certain embodiments, the cylindrical housing 1430 can protect* the detectors 1410c and conductors 1412c *more effectively than currently-available resin epoxies*, which are sometimes applied to solder joints between conductors and detectors.

Ex. 1001, 36:37–46 (emphases added); *see* PO Resp. 52. First, the sentence cited by Patent Owner begins with the phrase "[i]n certain embodiments," which indicates the claimed invention is not limited and is open to other embodiments, so there is no lexicography or disavowal here. Second, we agree with Petitioner's reading of this passage as distinguishing the prior art from the claimed invention based on the *location* of the material (applied only to solder joints between conductors and detectors in the prior art, as opposed to covering the conductors and detectors in the invention) and not the *type* of material. Third, at best, the '266 patent expresses a preference for a cover to be made of glass or plastic, because such materials provide "more effective[]" protection than resin epoxies that were known when the '266 patent was filed. *See id.* at 36:42–46. But even this reading recognizes that resin epoxies provide some amount of protection, albeit perhaps a lesser amount than glass or plastic, and are not excluded from forming the material of a cover.

Dr. Kenny's deposition testimony cited by Patent Owner also does not persuade us that, in the context of the '266 patent, epoxy or resin is excluded from the material of a cover. Dr. Kenny testifies that "a layer of sealing resin" "[c]ould" be used to protect the electronic components in a sensor (Ex. 2009, 395:22–396:8). He was then asked "So that would be one way to protect the components without using a cover, correct?" to which he answered "[t]here are many ways to protect the elements other than using a cover" and maintained that the proposed combination of prior art has a "cover" to achieve purposes *other than* protecting electronic components, i.e., "to improve adhesion and to improve light gathering for the operation of the system." *Id.* at 396:9–17. He did not squarely testify that sealing resin may never be a cover.

Accordingly, in the context of the ’266 patent, we do not construe the claimed “cover” to exclude epoxy and resin.

2. Other Claim Terms

Upon consideration of the entirety of the arguments and evidence presented, we conclude no further explicit construction of any claim term is needed to resolve the issues presented by the arguments and evidence of record. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (per curiam) (claim terms need to be construed “only to the extent necessary to resolve the controversy” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-obviousness.[4] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion

[4] Patent Owner does not present objective evidence of non-obviousness.

claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 4 (citing Ex. 1003 ¶¶ 21–22). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

Patent Owner makes several observations regarding Petitioner's identified level of skill in the art but, "[f]or this proceeding, [Patent Owner] nonetheless applies Petitioner's asserted level of skill." PO Resp. 10–11 (citing Ex. 2004 ¶¶ 35–38).

We adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa and Inokawa

Petitioner contends that claims 1–6, 8–16, 18, and 19 of the ’266 patent would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 7–44.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled “Pulse Wave Sensor and Pulse Rate Detector,” and discloses a pulse wave sensor that detects light output from a light emitting diode and reflected from a patient’s artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

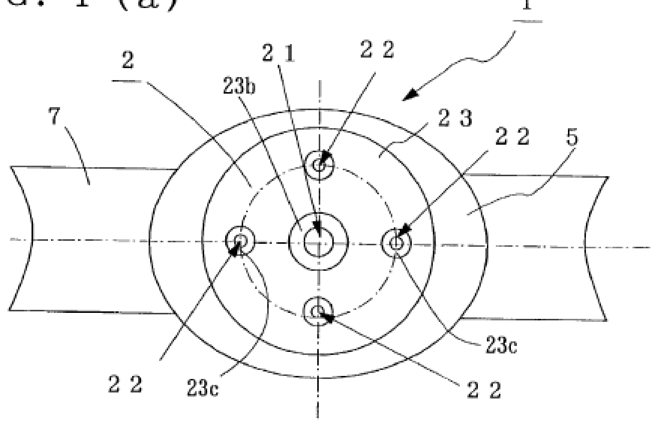


Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode (“LED”) 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, “to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased.” *Id.* ¶ 32, Fig. 4(a). “The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22.” *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

F I G. 1 (b)

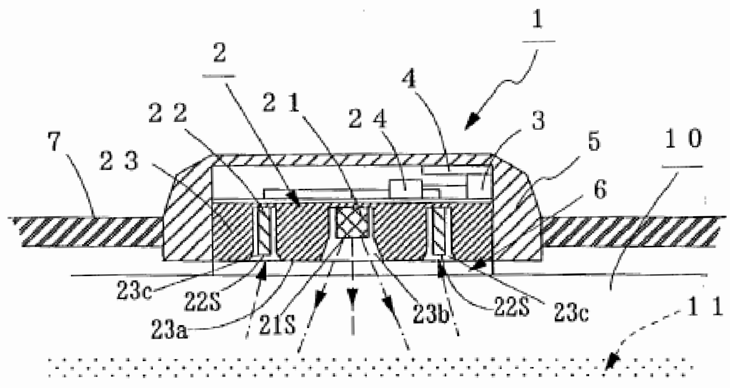


Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.*

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* Aizawa discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)." *Id.* ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic

transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. Overview of Inokawa (Ex. 1008)

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

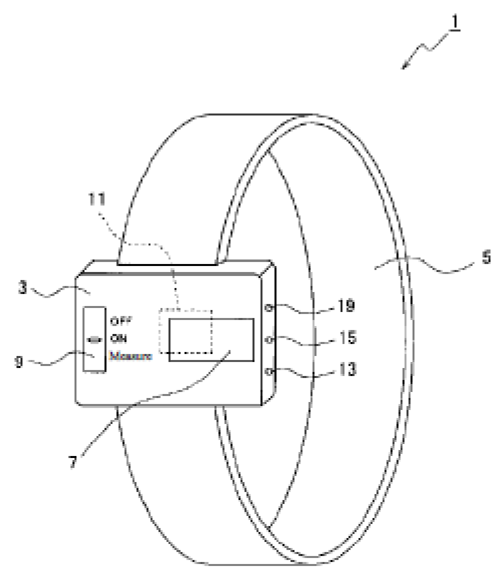


Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

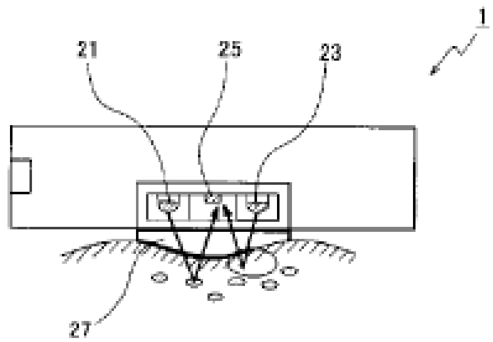


Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 senses "the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery)," and infrared LED 23 senses body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that "performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory." *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

(FIG. 3)

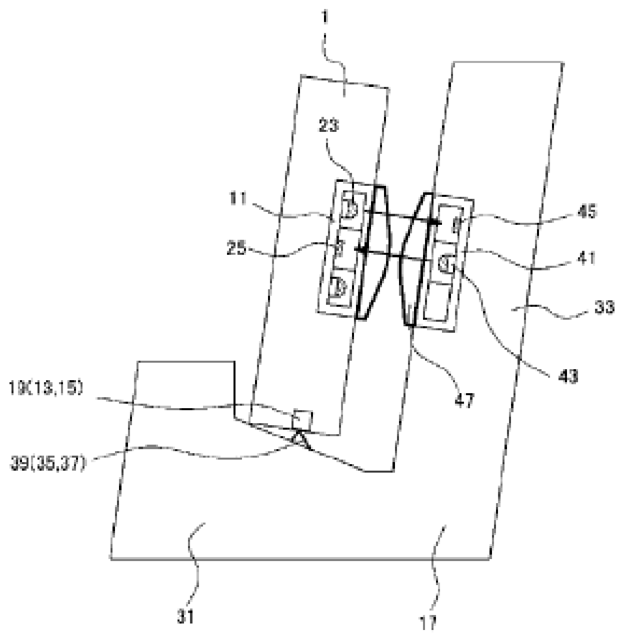


Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position, pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Independent Claim 1

Petitioner contends that claim 1 would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 13–23 (combination), 23–30 (claim 1).

i. A noninvasive optical physiological sensor comprising:"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses a noninvasive optical physiological sensor, i.e., a pulse sensor worn on a wearer's wrist. Pet. 23; *see, e.g.*, Ex. 1006 ¶ 2 ("[A] pulse wave sensor for detecting the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist with light.").

ii. [a] "a plurality of emitters configured to emit light into tissue of a user;"

Petitioner's Undisputed Contentions

Petitioner contends that Aizawa discloses one emitter—LED 21—and also states that, in certain embodiments, multiple LEDs may be employed. Pet. 7–8, 17–18. Patent Owner does not dispute this contention, and we agree with Petitioner. *See* Ex. 1006 ¶¶ 23 ("LED 21"), 32 ("The arrangement of the light emitting diode 21 and the photodetectors 22 is not limited to this."). For example, Aizawa explains that "[t]he same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector." *Id.* ¶ 33.

Petitioner also contends that Inokawa teaches a sensor with two LEDs–a green LED to sense pulse and an infrared LED to sense body motion. Pet. 10–11. Petitioner contends that when Inokawa's sensor is

mounted on a base device, the infrared LED also is used to wirelessly transmit vital information to the base device. *Id.* at 12–13. Patent Owner does not dispute these contentions, and we agree with Petitioner. Inokawa teaches a pair of LEDs 21, 23, where "the basic function of the S-side green LED 21 is to sense the pulse from the light reflected off of the body . . ., while the S-side infrared LED 23 serves to sense body motion from the change in this reflected light." Ex. 1008 ¶¶ 58–59. Inokawa also explains that "vital sign information stored in the memory 63 [of the sensor], such as pulse and body motion, is transmitted to the base device 17 using the S-side infrared LED 23 of the pulse sensor 1 and the B-side PD 45 of the base device 17," such that "there is no need to use a special wireless communication circuit or a communication cable." *Id.* ¶¶ 76–77.

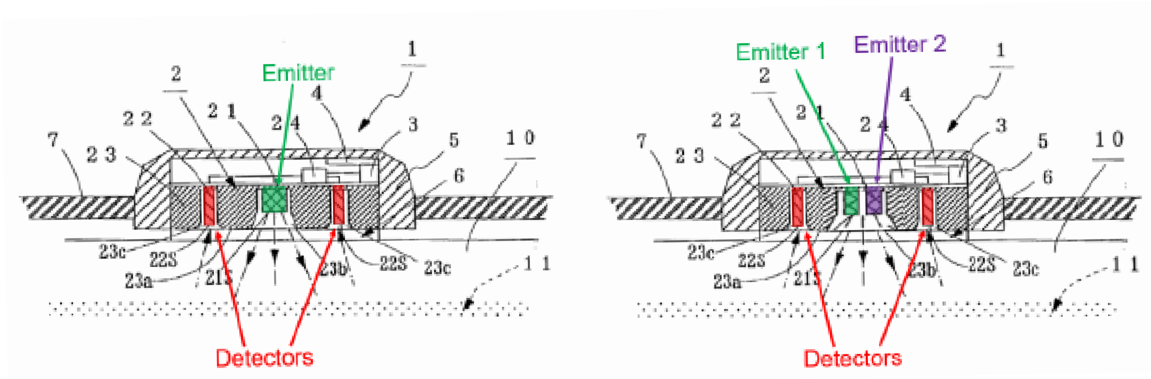
<u>Petitioner's Disputed Contentions</u>

Moreover, Petitioner contends that a person of ordinary skill in the art would have been motivated to "provid[e] an additional emitter to Aizawa [to] allow Aizawa's device to use its existing infrared LED to detect body motion while using the added green LED to detect pulse," which would have provided "more reliable pulse measurement that takes into account and corrects for inaccurate readings stemming from body movement." Pet. 18, 24; Ex. 1003 ¶¶ 71–73.

As a second and independent motivation, Petitioner also contends that incorporating Inokawa's teachings would have allowed for wireless data communication from Aizawa's sensor, without the need for a physical communications cable or a separate wireless communication circuit. Pet. 20–21. Petitioner contends that although Aizawa discloses data transmission, Aizawa "is silent about how such transmission would be

implemented.” *Id.* at 20. According to Petitioner, a skilled artisan “would have further recognized that incorporating Inokawa’s base device and LED-based data transmission would allow Aizawa to upload data from its sensor in a way that is wireless (thus avoiding the problems of a physical cable) and that does not require a separate RF circuit,” and which would “improve data transmission accuracy by using the second LED, such as the green LED, to transmit checksum information.” *Id.* at 21 (citing, e.g., Ex. 1003 ¶¶ 76–78).

To illustrate its proposed modification, Petitioner includes annotated and modified views of Aizawa’s Figure 1(b), reproduced below. Pet. 19; *see also id.* at 24 (same); Ex. 1003 ¶ 72.



Petitioner’s modified figures depict the sensor of Aizawa in which the single emitter has been divided into two emitters operating at two different wavelengths, as Petitioner contends would have been rendered obvious by Inokawa. Pet. 18–19, 23–24. Petitioner contends that this modification entails use of a known solution to improve similar systems in the same way and would have achieved predictable results. *Id.* at 19, 22–23 (citing Ex. 1003 ¶¶ 73–74, 80); *see also id.* at 23–24 (citing, e.g., Ex. 1003 ¶¶ 69–81).

Patent Owner's Arguments

Patent Owner disputes Petitioner's contentions regarding the obviousness of modifying Aizawa to include two emitters. *See* PO Resp. 37–43; Sur-reply 13–15.

First, Patent Owner argues that neither Aizawa nor Inokawa discloses a device with both multiple detectors *and* multiple emitters in the *same* sensor, because Aizawa's embodiments have either a single emitter and multiple detectors (e.g., Ex. 1006, Fig. 1(a)) or multiple emitters and a single detector (e.g., *id.* ¶ 33), and Inokawa discloses multiple emitters and a single detector (e.g., Ex. 1008, Fig. 2). *See* PO Resp. 37–38 (citing, e.g., Ex. 2004 ¶¶ 79–80).

Second, Patent Owner argues that the evidence does not support either of Petitioner's two proffered motivations for modifying Aizawa to include two emitters. As to the first motivation (to measure body movement using a second emitter), Patent Owner asserts that Dr. Kenny erroneously testifies that Aizawa cannot do this with its single emitter. PO Resp. 38 (citing, e.g., Ex. 1006 ¶ 15; Ex. 2007, 400:7–401:10; Ex. 2004 ¶ 84). Patent Owner argues that "Aizawa, however, expressly states that it provides a 'device for ***computing*** the ***amount*** of motion load from the pulse rate.'" *Id.* at 39.

As to Petitioner's second motivation (to enable transmission of data to a base device using an optical communication link), Patent Owner argues that "Aizawa ***already*** includes a wireless transmitter . . . so Aizawa does not need to incorporate Inokawa's base-device [optical] data transmission arrangement." PO Resp. 39–40 (citing, e.g., Ex. 1006 ¶¶ 23, 28, 35; Ex. 2004 ¶¶ 85–86). Indeed, Patent Owner argues "Dr. Kenny acknowledged Aizawa does not indicate there are any problems with Aizawa's form of data transmission." *Id.* at 40 (citing Ex. 2007, 409:13–

410:2). Patent Owner further argues that "Aizawa's goal is 'real-time measuring' with the transmitter 'transmitting the measured pulse rate data to a display'" but that "Inokawa's base device, however, only transmits pulse rate data 'when the pulse sensor . . . is mounted onto the base device'" and, thus, "***eliminates*** the ability to take and display ***real-time*** measurements." *Id.* at 40–41 (citing, e.g., Ex. 1006 ¶¶ 4, 15; Ex. 1008, Abstract; Ex. 2004 ¶ 86; Ex. 2009, 381:18–382:8, 383:22–385:9, 390:5–392:3).

Patent Owner insists Inokawa does not aid Petitioner's case, because Inokawa discloses the benefits of using a second emitter in only two situations, i.e., first, to improve over a "mechanically-connected system," e.g., with a cable for communication, and, second, to avoid use of a "dedicated wireless communication circuit," whereas "Aizawa ***already*** uses wireless transmission to provide real-time heart measurements." *Id.* at 41–42 (citing, e.g., Ex. 1008 ¶ 4; Ex. 2004 ¶ 87).

Third, Patent Owner accuses Petitioner and Dr. Kenny of overlooking further complications that would ensue from modifying Aizawa to have two emitters. Patent Owner argues that Dr. Kenny overlooked how placing "two LEDs in close proximity may cause thermal interference that could create significant issues for sensor performance." PO Resp. 42 (citing, e.g., Ex. 2004 ¶ 88; Ex. 2012, 76–77). Patent Owner also argues that in the proposed modification, when Dr. Kenny added a second LED, "he widened [Aizawa's] cavity in his figure without disclosing in his declaration that he had done so," which could impact optical performance of the device. *Id.* at 42–43.

Petitioner's Reply

Concerning Petitioner's first motivation, Petitioner asserts that Aizawa does not disclose any details related to data transmission, and adding an additional LED enables the sensor to distinguish between blood flow and body movement, which provides a "more reliable" pulse measurement, which is Petitioner's asserted improvement to Aizawa. Pet. Reply 16 (citing, e.g., Ex. 1003 ¶ 72; Ex. 2007, 401:11–402:4; Ex. 1047 ¶ 36). Moreover, Petitioner contends that by using multiple LEDs at different wavelengths, "two separate signals" can be collected, which "will allow Aizawa's system to 'take into account and correct for inaccurate readings related to body movement' by subtracting the 'signal component corresponding to body movement [] from the pulse signal to help better isolate the desired pulse data.'" *Id.* (quoting Ex. 1003 ¶ 72).

Concerning Petitioner's second motivation, Petitioner maintains that Inokawa's use of two emitters having different wavelengths to upload data to a base device using optical communication advantageously improves the accuracy of the transmission by providing checksum information. *Id.* at 17 (citing, e.g., Ex. 1003 ¶ 78; Ex. 1008 ¶ 111, 44, 48; Ex. 2007, 407:7–408:20, 416:5–15; Ex. 1047 ¶ 38). Moreover, Petitioner notes that Aizawa mentions real-time measurement only once and does not "mention that such data must also be transmitted to some external device in real time." *Id.* at 18 (citing Ex. 1047 ¶ 38). Likewise, Petitioner explains that a person of ordinary skill in the art "would have been fully capable of weighing potential benefits associated with different transmission methods, for instance recognizing that a quicker transmission may be achieved in one instance and a more accurate one in another." *Id.*

As to the "other complications" that Patent Owner alleges would result from the proposed modification, Petitioner asserts "such issues are 'part of what [a person of ordinary skill in the art] would bring . . . to the problem and would know how to make the changes needed.'" *Id.* at 18 (quoting Ex. 2007, 384:8–388:12; Ex. 1047 ¶ 39).

Patent Owner's Sur-reply

Concerning Petitioner's first motivation, Patent Owner argues that Inokawa's disclosure is just as sparse as Aizawa's disclosure regarding how to use optical data to measure body movement. Sur-reply 13–14 (citing Ex. 1008 ¶ 59). Patent Owner also asserts that "Petitioner cites nothing in Inokawa that suggests" that Inokawa's two emitter data gathering is more reliable or otherwise superior to Aizawa's single emitter data gathering. *Id.*

Concerning Petitioner's second motivation, Patent Owner argues that the proposed modification eliminates Aizawa's ability to conduct "***real-time*** collection and display of physiological measurements—a key goal of Aizawa's system." *Id.* at 14 (citing Ex. 1006 ¶¶ 4, 15; Ex. 2007, 402:6–11; Ex. 2020 ¶ 101).

Patent Owner also notes that Petitioner does not dispute that the proposed modification would cause problems such as "additional cost, energy use, and thermal problems" that would ensue from using two emitters in the Aizawa device. *Id.* at 15.

Analysis

Upon review of the foregoing, we conclude that a preponderance of the evidence supports Petitioner's contention that it would have been

obvious to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, in light of Inokawa.

First, a person of ordinary skill in the art would have been motivated to make this replacement to improve the pulse measurements recorded by Aizawa's detector 1. Inokawa teaches that the infrared LED's signal can be used "to detect vital signs" such as "body motion," and the green LED's signal can be "used to detect pulse." Ex. 1008, Fig. 2, ¶¶ 14, 58–59.

Patent Owner correctly points out that Aizawa describes its single-emitter detector 1 as transmitting its pulse data to "a device for computing the amount of motion load from the pulse rate." Ex. 1006 ¶¶ 15, 28, 35. But, this description is the only disclosure in Aizawa cited by Patent Owner as relating to computing a motion characteristic of the user. Further, we are unable to discern any other disclosure in Aizawa relating to motion computation, or what Aizawa proposes to do with its motion computation. *See id.* Based on the sparse nature of Aizawa's disclosure concerning motion load, it is not clear exactly what Aizawa proposes to do with the computed motion load, after it is computed. *See, e.g.*, Ex. 1047 ¶ 36 ("Patent Owner fails to explain how Aizawa senses and computes motion load. Indeed, Aizawa is completely silent on this point."). Aizawa does, however, describe the motion load as being computed "from the pulse rate," rather than being an input to the pulse rate calculation. Ex. 1006 ¶¶ 15, 35.

In a deposition for other proceedings related to this *inter partes* review, *see supra* § I.B, Dr. Kenny was asked whether it was his understanding that "Aizawa's sensor could not account for motion load?"; Dr. Kenny answered that "Aizawa's sensor attempts to prevent motion load rather than account for it." Ex. 2007, 400:7–11 (deposition for IPR2020-01520, IPR2020-01537, and IPR2020-01539). He explained that, because

Aizawa uses only a single emitter with a single wavelength, "what [Aizawa] sees as a signal would be some mixture of pulse rate and motion load if there was no effort to prevent motion load," so Aizawa seeks to solve the problem of "prevent[ing] motion load from corrupting the pulse rate signal." *Id.* at 400:12–401:10. Dr. Kenny did not further explain this distinction between preventing and accounting for motion load in his deposition testimony cited by the parties as relating to this issue. *Id.* at 400:7–402:4. We do not rely on this distinction as a basis for our present decision, because we find no express support for it in Aizawa's disclosure (*see* Ex. 1006 ¶¶ 15, 28, 35), and it is not explained in persuasive detail by Dr. Kenny.

We nonetheless credit Dr. Kenny's declaration testimony that a person of ordinary skill in the art, upon reviewing Inokawa's disclosure of using two emitters of different wavelengths to calculate a user's pulse and motion separately, would have understood that these two separate measurements would "allow for a more reliable pulse measurement that takes into account *and corrects for* inaccurate readings stemming from body movement" by "subtracting the 'signal component corresponding to body movement [] from the pulse signal to help better isolate the desired pulse data." Ex. 1047 ¶¶ 36, 37 ("processed in a way to compensate for movement and create a more reliable measurement of the physiological parameter"); Ex. 1003 ¶¶ 71–73. Aizawa does not disclose using the computed motion load in this fashion, so it appears that this would improve upon the accuracy of Aizawa's pulse measurements, by using the computed motion load to isolate and account for noise. *See* Ex. 1006 ¶¶ 15, 28, 35.

Dr. Madisetti offers no meaningful opposing testimony in this regard. *See, e.g.*, Ex. 2004 ¶ 84. Instead, Dr. Madisetti incorrectly reads Dr. Kenny's motivation testimony as being limited to the desirability of

adding the bare ability to measure body movement to Aizawa. *See id.* In fact, Dr. Kenny further testified that it would have been beneficial to *use* the measured body movement to *improve* the pulse measurement of the device. *See* Ex. 1003 ¶¶ 71–74; Ex. 1047 ¶¶ 36–37. Dr. Madisetti does not address that testimony. *See* Ex. 2004 ¶ 84.

Thus, because Dr. Madisetti's testimony sets up a straw man to attack, rather than directly addressing the entirety of Dr. Kenny's testimony in this regard, Dr. Kenny's testimony stands unrebutted in the record before us. Dr. Kenny's testimony also makes intuitive sense that measuring the user's motion *separately* from the user's pulse, for example by using two interrogating emitters of two different wavelengths, would provide a reliable means of correcting the pulse data for motion artifacts by using the separately measured motion data, rather than by trying to segregate these two components in the single data stream provided by Aizawa's single emitter device. *See, e.g.*, Ex. 1047 ¶¶ 36–37. We, therefore, are persuaded by Dr. Kenny's unrebutted testimony that using two emitters of different wavelengths would improve Aizawa's device in this way.

Independently, we are also persuaded that a person of ordinary skill in the art would have been motivated to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, to provide a reliable method of uploading pulse data stored by Aizawa's wrist-worn pulse rate detector 1 to another device for display to the user. Inokawa expressly touts such optically-based uploading of data from Inokawa's wrist-worn sensor 1 to Inokawa's base device 17 as a benefit of incorporating two emitters in sensor 1. *See* Ex. 1008, Figs. 3, 19, ¶¶ 3–7, 14, 76–77, 109–111. Inokawa identifies two specific benefits of this optically-based data communication means. First, the infrared LED can transmit the pulse data, and the green

LED can separately transmit "checksum" information to increase the accuracy of data transmission. *Id.* at Fig. 19, ¶¶ 14, 109–111. Second, using light emitters in this fashion to perform two functions (data collection by emitting light into the user's wrist, and data transmission by emitting light to photodetectors in a base device) obviates the need for providing "a special wireless communication circuit [in the wrist-worn sensor 1] or a communication cable." *Id.* ¶¶ 3–7, 76–77.

Patent Owner correctly points out that Aizawa already has a "transmitter" 4 for uploading pulse data stored by Aizawa's wrist-worn pulse rate detector 1 to another device for processing and for display to the user. Ex. 1006, Fig. 1(b), ¶¶ 15, 23, 28, 35. However, Aizawa's Figure 1(b) illustrates transmitter 4 only as an empty box contained within outer casing 5, and Aizawa's written description does not provide further structural details concerning transmitter 4. *See id.* In particular, Aizawa does not describe exactly how transmitter 4 transmits its data to the other device. *See id.*

Patent Owner contends that Aizawa's transmitter 4 is a "wireless" transmitter, and Dr. Kenny agreed to as much during his deposition. *See, e.g.*, PO Resp. 40; Ex. 2007, 414:19–21. They appear to equate "wireless" communication to radio frequency communication, and not to include optical communication, even though both radio frequency and optical communication do not use a wire. Based on the foregoing testimony, we assume, for this decision, that Aizawa contemplates radio frequency communication as one embodiment by which transmitter 4 may transmit data to devices other than detector 1.

Patent Owner argues, and Dr. Madisetti testifies, that Aizawa's express disclosure goes even further. They assert Aizawa's "goal" is to

measure and display pulse data *in real time during exercise*, using the wireless transmitter. *See, e.g.*, PO Resp. 39–40; Ex. 2004 ¶¶ 86 ("the ability to take and display real-time measurements, one of Aizawa's stated goals"), 87. We find that Aizawa does not support this assertion. Instead, Aizawa discusses prior art devices that "estimat[e] a burden on the heart of a person who takes exercise by *real-time measuring* his/her heart rate at the time of exercise" (Ex. 1006 ¶ 4 (emphasis added)), and then describes Aizawa's detector 1 as having a transmitter for transmitting the measured pulse rate data to another device for display (*id.* ¶ 15). Aizawa does not indicate when this transmission occurs. Aizawa also refers to "noise caused by the shaking of the body of the subject" as a problem to be addressed (*id.* ¶ 6), but this problem occurs regardless of whether the shaking results from exercise or the normal movement of the user's wrist over the course of the day. Thus, Aizawa does not tout, as an important feature of Aizawa's invention, the *real time display* of pulse rate data during exercise, regardless of whether the data gathered by Aizawa's wrist-worn detector 1 is transmitted wirelessly or otherwise. *Id.* ¶¶ 4, 6, 15.

No doubt, a person of ordinary skill in the art would have viewed the capability of a wrist-worn pulse detector to transmit its pulse data to another device for display in real time while the user is exercising to be a desirable feature in some cases, even if this is not one of Aizawa's specifically stated goals. *See, e.g.*, Ex. 1048 ¶ 67 (Dr. Kenny stating: "By wirelessly transmitting the collected data . . . the condition of a subject [can be determined] 'remotely.'"); Ex. 2009, 393:6–14 (in a deposition for other related proceedings, Dr. Kenny agreeing that a person of ordinary skill in the art "would have seen the ability to wirelessly transmit collected data as an advantage"). Nonetheless, Inokawa expressly discloses that, in other cases,

the benefits achieved by wireless transmission can be outweighed by obviating the need for the wrist-worn sensor to include a special wireless communication circuit. *See* Ex. 1008 ¶¶ 3–7 (discussing problems associated with wireless transmission, such as the need for a dedicated circuit, which is avoided by Inokawa's system that risks "few malfunctions" and has a "simple structure"), 76–77 ("As a result, there is no need to use a special wireless communication circuit . . ., which makes it possible to transmit vital sign information to the base device 17 accurately, easily, and without malfunction."). We therefore conclude that Petitioner's case for obviousness in this regard is supported by a preponderance of the evidence. *See, e.g., In re Urbanski*, 809 F.3d 1237, 1243–44 (Fed. Cir. 2016) (persons of ordinary skill in the art may be motivated to pursue desirable properties of one prior art reference, even at the expense of foregoing a benefit taught by another prior art reference).

We disagree with Patent Owner's argument that Petitioner's case for obviousness is deficient on the basis that neither Aizawa nor Inokawa expressly discloses a wrist-worn sensor device that has *both* a plurality of emitters *and* at least four detectors, as claim 1 recites. Obviousness does not require "'some motivation or suggestion to combine the prior art teachings' [to] be found in the prior art." *KSR*, 550 U.S. at 407, 415–418. Nor does it require the bodily incorporation of Inokawa's device into Aizawa's device. *See, e.g., In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (test for obviousness is not whether the features of one reference may be bodily incorporated into the structure of the other reference, but rather is "what the combined teachings of the references would have suggested to those of ordinary skill in the art"); *see also In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (nonobviousness is not established by attacking references

individually when unpatentability is predicated upon a combination of prior art disclosures). Instead, "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton," and "in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *KSR*, 550 U.S. at 420–421.

In this case, we are persuaded that a person of ordinary skill in the art would have been motivated to modify Aizawa's wrist-worn detector 1 to replace its single near infrared LED 21 with an infrared LED and a green LED, based on Inokawa, for all the reasons provided above. A person of ordinary skill in the art would additionally have known to keep all four detectors 22 that are already present in Aizawa's detector 1, so that "[e]ven when the attachment position of the sensor is dislocated, a pulse wave can be detected accurately," as disclosed by Aizawa. Ex. 1006 ¶¶ 9, 27. In short, the combination of Aizawa and Inokawa teaches that having multiple emitters is beneficial, and having multiple detectors is beneficial, for different and not inconsistent reasons.

Finally, we agree with Petitioner's position that any thermal interference and power consumption issues that may arise in Aizawa's wrist-worn pulse detector, by using two emitters instead of one emitter, are well within the capabilities of a person of ordinary skill in the art to solve. We credit Dr. Kenny's testimony in this regard. *See* Ex. 1003 ¶¶ 74, 80 ("would have led to the predictable result of more accurate and convenient data transmission without significantly altering or hindering the functions performed by Aizawa's sensor"); Ex. 1047 ¶ 39. For example, Dr. Kenny acknowledges that Aizawa already discloses adding additional emitters. Ex. 1003 ¶ 39 (citing Ex. 1006 ¶ 33). Dr. Kenny further testifies that this modification "amount[s] to nothing more than the use of a known technique

[i.e., Inokawa's use of two emitters in a wrist-worn pulse detector] to improve similar devices [i.e., Aizawa's wrist-worn pulse detector] in the same way, and combining prior art elements according to known methods to yield predictable results." *Id.* ¶¶ 74, 80.

Patent Owner cites portions of Dr. Kenny's deposition testimony that, in Patent Owner's view, indicate Dr. Kenny fails to appreciate the significance of optical interference complications posed by adding a second emitter to Aizawa's device, and fails to explain how this would have been overcome. *See* PO Resp. 42–43 (citing Ex. 2007, 379:17–21, 384:16–388:16, 389:17–390:20, 394:11–395:17). We have reviewed this deposition testimony, and we conclude Patent Owner overstates its significance. It establishes, at most, that Dr. Kenny did not expressly address this issue in his declaration (Exhibit 1003), but Dr. Kenny's opinion is that this would have been within the capability of a person of ordinary skill in the art to resolve. Based on the evidentiary record presented to us, we agree with Dr. Kenny. For example, Inokawa discloses a wrist-worn pulse sensor 1 having two emitters 21 and 23 in close proximity to each other. *See* Ex. 1008, Figs. 1–2. An artisan must be presumed to know something about the art apart from what the relied-upon references disclose. *See In re Jacoby*, 309 F.2d 513, 516 (CCPA 1962).

Dr. Madisetti's testimony opposing Dr. Kenny's foregoing opinion is premised solely on Dr. Kenny's alleged failure to explain how issues that arise from adding a second emitter to Aizawa would have been solved; Dr. Madisetti does not provide any affirmative reason why these issues would have been difficult for a person of ordinary skill in the art to solve, in the context of Aizawa's device or wrist-worn pulse sensing devices in general. *See* Ex. 2004 ¶ 88.

Thus, we conclude a person of ordinary skill in the art would have been motivated to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, and would have had a reasonable expectation of success in doing so.

iii. "[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses at least four detectors 22 that detect light that has been emitted by LED 21 and attenuated by body tissue. Pet. 24–25; *see, e.g.*, Ex. 1006 ¶ 27 (disclosing that light emitted from LED 21 "is reflected by a red corpuscle running through the artery 11 of the wrist 10 and . . . is detected by the plurality of photodetectors 22 so as to detect a pulse wave"); Ex. 1003 ¶¶ 82–83.

iv. "[c] a housing configured to house at least the plurality of detectors; and"

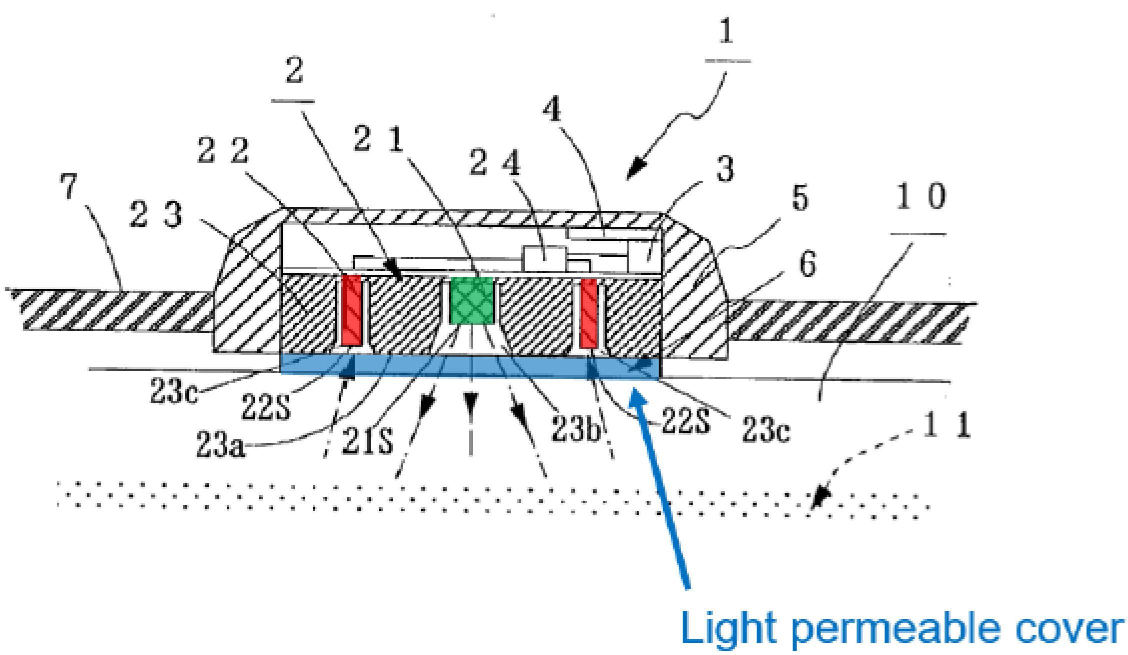
The cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23, which houses the detectors in a portion of the housing. Pet. 25–26; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing . . . light emitting diode 21 and the photodetectors 22"), Figs. 1(a)–(b) (depicting holder 23 surrounding detectors 22).

v. "[d] a lens configured to be located between the tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a

> *portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor worn by the user and during operation of the noninvasive optical physiological sensor."*

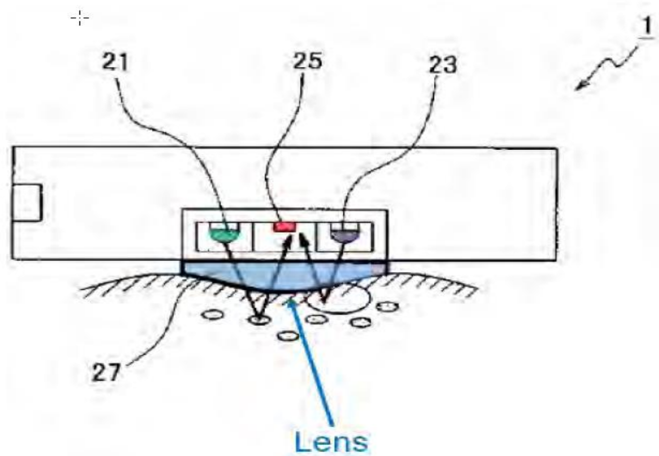
<u>Petitioner's Contentions</u>

With reference to an annotated version of Aizawa's Figure 1(b) (reproduced below), Petitioner contends that Aizawa "teaches a light permeable cover in the form of an acrylic transparent plate 6 (blue) that is mounted at the detection face 23a" of the sensor, between the user's tissue and the emitter/detector assembly. Pet. 8–9 (citing Ex. 1006, Fig. 1(b), ¶ 23); Ex. 1003 ¶¶ 55–56.



The figure above shows Petitioner's annotated version of Aizawa's Figure 1(b), in which transparent plate 6 is shaded in blue and identified as "Light permeable cover." Petitioner contends that beyond disclosing that the acrylic transparent plate "helps improve 'detection efficiency,' Aizawa does not provide much other detail, for instance regarding its shape." *Id.* at 14 (citing Ex. 1006 ¶ 30).

Petitioner reasons, however, that one of ordinary skill in the art would have "looked to Inokawa to enhance light collection efficiency, specifically by modifying the flat cover of Aizawa to include a lens." *Id.* at 14 (citing Ex. 1003 ¶¶ 87–91), 27–28 ("obvious to modify the flat acrylic plate of Aizawa . . . into a lens having a single outwardly protruding convex surface . . . to further Aizawa's objective of enhancing its light collection efficiency"). In that regard, Petitioner points to Inokawa's Figure 2. Petitioner's annotated version of that figure is reproduced below.

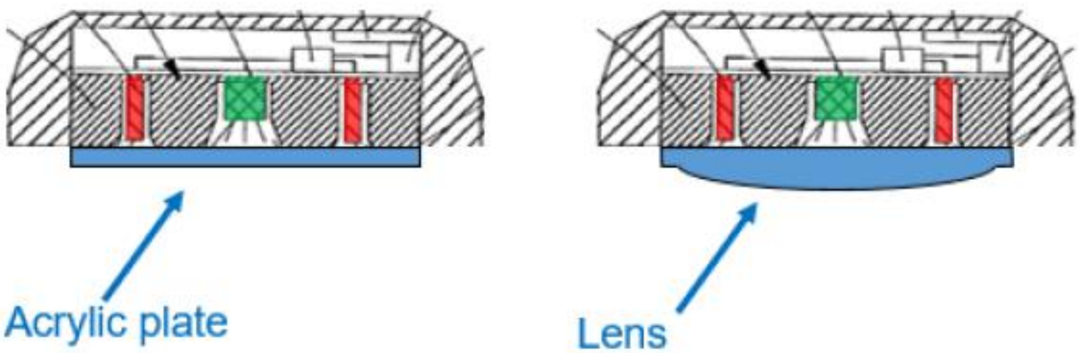


Id. at 14. Figure 2 above depicts Inokawa's lens 27 shaded in blue.

Petitioner expresses that Inokawa teaches that its cover may be either flat such that the surface is less prone to scratches or may be in the form of the lens shape shown above to "increase the light-gathering ability of the LED." *Id.* at 15–16 (quoting Ex. 1008 ¶¶ 15, 106); *see* Ex. 1003 ¶¶ 88–91. Petitioner contends that a person of ordinary skill in the art "making the design choice to prioritize improved improved light collection efficiency over reduced suseptibility to scratches could have readily modified Aizawa's cover to have a lens as per Inokawa." Pet. 16 (citing Ex. 1003 ¶ 91). Petitioner also contends that a skilled artisan would have had a reasonable expectation of success in combining those teachings. *Id.* at 15–16 (citing

Ex. 1003 ¶ 90). Petitioner adds that Aizawa's "transparent acrylic material . . . can be readily formed into a lens as in Inokawa." *Id.* at 16 (citing Ex. 1003 ¶ 91; Ex. 1009, 3:46–51, Fig. 1; Ex. 1023, Fig. 6, ¶¶ 22, 32, 35).

Petitioner provides annotated and modified versions of Aizawa's Figure 1(b) that depict the modification of the proposed combination, which are reproduced below. *Id.* at 15 (citing Ex. 1003 ¶ 89).



Petitioner's annotated figure on the left depicts the device with Aizawa's flat cover, wherein the annotated and modified figure on the right depicts the device resulting from the combination of Aizawa and Inokawa, in which a person of ordinary skill in the art would have replaced Aizawa's flat cover with a curved protrusion to "increase the light-gathering ability." *Id.* (quoting Ex. 1008 ¶ 15).

According to Petitioner, a person of ordinary skill in the art "would have understood how to implement Inokawa's lens[]in Aizawa's device with a reasonable expectation of success." Pet. 15–16 (citing Ex. 1003 ¶ 90). The shape of the modified cover in Dr. Kenny's illustration of the proposed modification above is similar to the shape of an LED lens illustrated in

Exhibit 1023 (hereafter "Nishikawa"),[5] referenced by Petitioner and Dr. Kenny in in connection with the proposed ground of unpatentability. *Compare* Pet. 15 (illustrating proposed modification), *with* Ex. 1023, Fig. 6, ¶¶ 3, 22, 30, 32, 35 (illustrating lens 50 used with LED 22, and discussing how to make the illustrated device); *see also* Pet. 16 (citing Ex. 1023), 51–52 (discussing teachings of Ex. 1023).

Petitioner also contends that, in the proposed modification, the convex surface of the lens will cause the user's tissue to conform because the rigid cover will be pressed against the user's skin with pressure. Pet. 28–30; Ex. 1003 ¶¶ 92–93, 98; Ex. 1006 ¶¶ 6, 23, 26, 30, 34; Ex. 1008, Fig. 2.

Patent Owner's Arguments

Patent Owner contends that the evidence does not support Petitioner's argument that it would have been obvious to modify Aizawa's cover to have a lens with an outwardly protruding convex surface, in order to improve detection efficiency by directing incoming light to Aizawa's photodetectors 22, with a reasonable expectation of success. PO Resp. 16–37; PO Sur-reply 2–13; Ex. 2004 ¶¶ 48–78.

According to Patent Owner, the evidence establishes that Petitioner's proposed modification would direct light *toward the center* of Aizawa's detector 1 where emitter 21 is located, rather than *toward the periphery* where detectors 22 are located. PO Resp. 16–24; Ex. 2004 ¶¶ 48–65. Thus, Patent Owner's view is that a person of ordinary skill in the art "would ***not*** have expected Inokawa's protruding surface to accomplish" the objective of enhancing light collection efficiency relied upon by Petitioner, because

[5] U.S. Patent Application Publication No. 2007/0145255 A1, filed Dec. 20, 2006, published June 28, 2007 (Ex. 1023).

Petitioner's proposed modification instead "would direct light ***away*** from the ***periphery***-located detectors" in Aizawa, the opposite result to Petitioner's contention. PO Resp. 20; Ex. 2004 ¶¶ 42–43, 48–57.

In support, Patent Owner points to Inokawa's Figure 2, in which two arrows illustrate light that passes through the convex protrusion of lens 27 toward the center of Inokawa's pulse sensor 1 where detector 25 is located. PO Resp. 17–18 (citing Ex. 1008 ¶ 58); Ex. 2004 ¶¶ 51–52. Patent Owner also points to the '266 patent's Figure 14B, which illustrates several light rays 1420, 1422 passing through a partially cylindrical protrusion 605 to be centrally focused on detector(s) 1410B. PO Resp. 18–19 (citing Ex. 1001, 35:57–60, 35:67–36:2; Ex. 2004 ¶¶ 53–54). Patent Owner cites portions of Dr. Kenny's deposition testimony that, in Patent Owner's view, support Patent Owner's contentions in these regards. *See* PO Resp. 2–3, 16–18 (citing Ex. 2006, 83:15–84:2, 86:19–87:1, 108:21–109:14, 202:11–204:20).

Patent Owner also asserts that "Dr. Kenny admitted that the impact of Inokawa's convex lens would not be 'obvious' in the context of [the] different configuration of LEDs and detectors" presented by Aizawa. PO Resp. 20–21 (citing Ex. 2006, 87:2–6). For example, Patent Owner points out that "light reaching Aizawa's detectors must travel in an opposite direction from the light in Inokawa." *Id.* at 21–22 (Ex. 2004 ¶¶ 59–62). In addition, according to Patent Owner, "Petitioner's combination is particularly problematic because" Aizawa uses "small detectors [22] with small openings [of cavities 23c] surrounded by a ***large*** amount of ***opaque*** material." PO Resp. 22 (citing Ex. 1006, Fig. 1(a); Ex. 2004 ¶ 63). In support of its view, Patent Owner cites portions of Dr. Kenny's deposition testimony. *Id.* at 23 (citing Ex. 2006, 257:11–18). Patent Owner also argues that to account for this, "Petitioner is forced to increase the size of Aizawa's

detectors approximately five-fold and eliminate Aizawa's large opaque barriers—with no analysis or explanation of such changes or the[ir] impact." *Id.* at 23–24 (citing Ex. 2004 ¶ 65).

Patent Owner further argues that Dr. Kenny, during his deposition, attempted to evade the foregoing problems by "disclaim[ing] Petitioner's reasoning [for obviousness] and assert[ing] new and improper opinions" that undermine the reasoning provided in the Petition. PO Resp. 24. For example, Patent Owner asserts that Dr. Kenny's attempt to distinguish between the '266 patent's Figure 14B as illustrating a lens that condenses *collimated* light toward the center, as compared to Aizawa and Inokawa in which the lens focuses *diffuse* light reflected by the user's body; Patent Owner argues this is not persuasive and is not supported by record evidence. PO Resp. 24–26 (citing Ex. 2006, 170:9–171:5; Ex. 2007, 288:13–289:5, 294:17–298:10, 298:11–299:18, 423:7–424:18; Ex. 2004 ¶¶ 67–68). Patent Owner also objects to Dr. Kenny's testimony that, "while a protruding surface would generally direct more light to the center," it "would also capture some light that otherwise would not be captured" by Aizawa's detectors 22, as lacking evidentiary support and relying on impermissible hindsight. PO Resp. 28–29 (citing Ex. 2004 ¶ 69–71; Ex. 2006, 204:21–206:5, 206:22–208:1; Ex. 2007, 294:17–298:10).

Patent Owner moreover asserts that "Dr. Kenny repeatedly distanced himself from his own similar combination" of Aizawa and Inokawa by refusing to talk about the specific shape, size, material, and dimensional tolerances of the combination, so, in Patent Owner's view, his testimony falls short because it demonstrates at most only that the references could have been combined. *Id.* at 2–3, 27–31 (citing, e.g., Ex. 2004 ¶¶ 71–73; Ex. 2006, 51:14–52:16, 75:20–77:2, 91:9–92:13, 96:20–21, 97:11–21,

100:17–101:18, 132:10–18, 154:4–7, 164:8–16, 189:11–190:3; Ex. 2007, 308:12–309:8, 310:18–311:9, 318:3–6, 324:21–325:19, 333:20–335:4).

Indeed, according to Patent Owner, because ordinary skill does not require specific education or experience with optics or optical physiological monitors (*see supra* Section II.C), "[i]t strains credibility that a [person of ordinary skill in the art] . . . could balance all of the factors Dr. Kenny identified" to reach the claimed invention. PO Resp. 31–32. Patent Owner relies on Dr. Kenny's testimony as establishing the complexity of designing optical physiological sensors. *Id.* at 3–4, 32–33 (citing Ex. 2006, 86:19–87:6; Ex. 2007, 331:19–332:11, 336:11–337:15). Patent Owner concludes Petitioner has failed to establish a reasonable expectation of success because Dr. Kenny's testimony "focuses almost entirely on manufacturing." *Id.* at 33 (citing Ex. 1003 ¶ 91; Ex. 2004 ¶ 75).

Patent Owner moreover asserts Petitioner errs in relying on Nishikawa as supporting the unpatentability of claim 1, because Nishikawa is "not identified as part of" the ground, which instead "includes only two references," Aizawa and Inokawa. PO Resp. 34 (citing Pet. 14; Ex. 1003 ¶¶ 86–91); *id.* at 35–36 (citing 35 U.S.C. § 312(a)(3); *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016)). Patent Owner asserts Dr. Kenny "relies heavily" on Nishikawa, particularly "to inform the specific shape of the cover in his similar combination, which is found nowhere in Aizawa and Inokawa." *Id.* at 34–35 (citing Ex. 2004 ¶¶ 76–77; Ex. 2006, 179:21–180:13; Ex. 2007, 364:2–13; Ex. 2008, 73:8–12).

Furthermore, in Patent Owner's view, Dr. Kenny's reliance on Nishikawa "make[s] no sense" because "Nishikawa's device is not a physiological sensor" but rather is "an encapsulated LED" that "directs

outgoing light through the encapsulation material and thus focuses on the emission of light, not the detection of an optical signal." PO Resp. 36 (citing Ex. 1023, code (57), ¶¶ 3, 32, 35; Ex. 2004 ¶ 78). Patent Owner contrasts such disclosure with Aizawa and Inokawa, both of which "detect[] ***incoming*** light that passes through the cover and reaches the detectors," and which have a "drastically" smaller scale than Nishikawa's LEDs. *Id.* at 36–37 (citing Ex. 1008, Fig. 2; Ex. 2004 ¶ 78).

<u>Petitioner's Reply</u>

In reply, Petitioner insists "Inokawa's lens enhances the light-gathering ability of Aizawa," which would have motivated an ordinarily skilled artisan "to incorporate 'an Inokawa-like lens [having a protrusion] into the cover of Aizawa to increase the light collection efficiency.'" Pet. Reply 2–3 (citing Pet. 13–15; Ex. 1003 ¶¶ 86–89; Ex. 1008, Fig. 2, ¶¶ 15, 58). Petitioner dismisses Patent Owner's and Dr. Madisetti's opposition as being "misinformed" because a person of ordinary skill in the art "would understand that Inokawa's lens generally improves 'light concentration at pretty much all of the locations under the curvature of the lens,' as opposed to only at a single point at the center." *Id.* at 3 (quoting Ex. 2006, 164:8–16); Ex. 1047 ¶¶ 7–9.

For example, Petitioner contends that Patent Owner and Dr. Madisetti "ignore[] the well-known principle of reversibility," by which "a ray going from P to S will trace the same route as one from S to P." Pet. Reply 4

(underlining omitted) (citing, e.g., Ex. 1052,[6] 84, 87–92); Ex. 1047 ¶¶ 10–22. Petitioner contends that Dr. Madisetti was evasive when he was asked to apply the reversibility principle to the combination of Aizawa and Inokawa in this case. Pet. Reply 6 (citing Ex. 1034, 89:12–19). Petitioner further contends that, "based at least on the principle of reversibility," one of ordinary skill in the art "would have understood that both configurations of LEDs and detectors—i.e., with the LED at the center as in Aizawa or with the detector at the center as in Inokawa—would similarly benefit from the enhanced light-gathering ability of an Inokawa-like lens." *Id.* at 9 (citing Ex. 1047 ¶ 22).

Petitioner also asserts that Patent Owner and Dr. Madisetti overlook the fact that light rays reflected by body tissue in the user's wrist, to be received by detectors in either Aizawa's or Inokawa's pulse sensor, will be "scattered" and "diffuse" and, therefore, will approach the detectors "from various random directions and angles." Pet. Reply 9–10, 13 (annotating Inokawa's Fig. 2 to illustrate the cause and nature of the back-scattering); Ex. 1047 ¶¶ 23–26. This scattered and diffuse light, according to Petitioner, means that Inokawa's "lens cannot focus all incoming light toward the sensor's center," as Patent Owner would have it. Pet. Reply 9 (citing Ex. 1047 ¶ 23; Ex. 2006, 163:12–164:2). Petitioner asserts this is due to

[6] Eugene Hecht, *Optics* (2nd ed. 1990). It is apparent that the page numbering identified by Petitioner for Exhibit 1052 refers to the documents native page numbering and not the page numbering of the exhibit appearing at the bottom, middle of each page. For clarity and consistency, in this Decision, we also refer to the same page numbering as Petitioner for Exhibit 1052.

Snell's law, and provides several illustrations to illustrate why. *Id.* at 9–15 (citing, e.g., Ex. 1047 ¶¶ 23–34).

Due to the random nature of this scattered light, Petitioner explains that one of ordinary skill in the art would have understood that a convex cover "provides a slight refracting effect, such that light rays that may have missed the detection area are instead directed toward that area." Pet. Reply 10 (citing Ex. 1047 ¶¶ 25–26). Petitioner applies this understanding to Aizawa, and contends that using a lens with a convex protrusion in Aizawa would "enable backscattered light to be detected within a circular active detection area surrounding" a central light source. *Id.*

Moreover, Petitioner dismisses the applicability of Figure 14B of the '266 patent as illustrating the operation of a *transmittance*-type of sensor that measures the attenuation of collimated light transmitted through the user's body tissue, rather than the *reflectance*-type sensor of Aizawa. *Id.* at 11–13 (citing, e.g., Ex. 1001, 35:65–67; Ex. 1047 ¶¶ 27–31).

Petitioner further maintains that Patent Owner's argument that Petitioner's illustrations of the light-focusing properties of a convex lens discussed in the Petition filed in IPR2020-01520 (Ex. 2019, 39) and relied upon by Dr. Kenny (Ex. 2020, 119–120) does not demonstrate "that a convex lens directs all light to the center." Pet. Reply 15 (citing PO Resp. 16–18). Petitioner contends these illustrations, instead, "are merely simplified diagrams included to illustrate . . . one example scenario (based on just one ray and one corpuscle) where a light permeable cover can 'reduce a mean path length of light traveling to the at least four detectors'" as recited in a claim challenged in that proceeding. *Id.* (citing, e.g., Ex. 1047 ¶ 34).

Patent Owner's Sur-reply

Patent Owner asserts that Petitioner's Reply improperly presents several new arguments, relying on new evidence, as compared with the Petition. *See, e.g.*, PO Sur-reply 1 ("new optics theories" and "new arguments"), 2, 6, 7, 9, 10, 12, 13.

Patent Owner also contends that Petitioner mischaracterizes Patent Owner's position, which is not that Inokawa's lens with a convex protrusion "would direct '***all***' light 'only at a ***single point*** at the center'" of the sensor. *Id.* at 2, n.2 (quoting Pet. Reply 3; citing, e.g., Ex. 2027, 63:7–64:6, 94:20–96:1, 96:18–97:7). Patent Owner's position, rather, is that Inokawa's lens condenses more light (not necessarily all light) "***towards the center*** of the sensor" as compared to a flat surface. *Id.* at 2 (quoting PO Resp. 19; citing, e.g., Ex. 2004 ¶¶ 34, 43, 49, 51–52, 54–55, 67).

Patent Owner moreover asserts "[t]here can be no legitimate dispute that a convex surface directs light centrally (and away from the periphery)." PO Sur-reply 3–6 (citing PO Resp. 16–19; Ex. 2006, 164:8–16, 166:10–17, 170:22–171:5; Ex. 2020 ¶¶ 119, 200; Ex. 2027, 181:9–182:5). Patent Owner contends that Petitioner's argument "that Inokawa would improve light-gathering at all locations, ***regardless*** of the location of the LEDs and detectors" is belied by Dr. Kenny's testimony that "Inokawa's benefit would ***not*** be clear if Inokawa's LEDs and detectors were moved" and "confirmed that a convex surface would direct light toward the center of the underlying sensor." *Id.* at 5–6 (citing Pet. Reply 3–4; Ex. 2006, 86:19–87:6, 202:11–204:20).

Patent Owner argues that Petitioner's discussion of the principle of reversibility is "irrelevant" because it "assumes ideal conditions that are not present when tissue scatters and absorbs light." PO Sur-reply 6–8 (citing

Ex. 2027, 17:12–19:2, 29:11–30:7, 31:8–32:3, 38:17–42:6, 207:9–209:21, 210:8–211:6). The random nature of backscattered light, in Patent Owner's view, "hardly supports Petitioner's argument that light will necessarily travel the same paths regardless of whether the LEDs and detectors are reversed," and is irrelevant to the central issue presented here of "whether a convex surface—***as compared with a flat surface***—would collect and focus additional light on Aizawa's peripherally located detectors." *Id.* at 8–9 (citing Ex. 2027, 212:3–14).

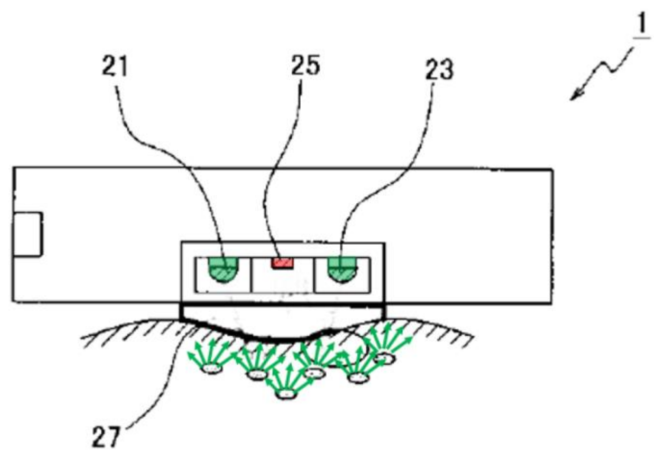
Patent Owner also argues that Petitioner's position that a convex cover will provide a "***slight***" refracting effect, "directly undermines Petitioner's provided ***motivation*** to combine," i.e., to enhance light collection efficiency. *Id.* at 10–11.

Analysis

Upon review of the foregoing, we conclude that a preponderance of the evidence supports Petitioner's view that it would have been obvious to modify Aizawa's cover 6 to include a lens with a single outwardly protruding convex surface like that taught in Inokawa, in order to increase the amount of backscattered light that will be received by Aizawa's four peripheral detectors 22, as compared with Aizawa's existing flat cover.

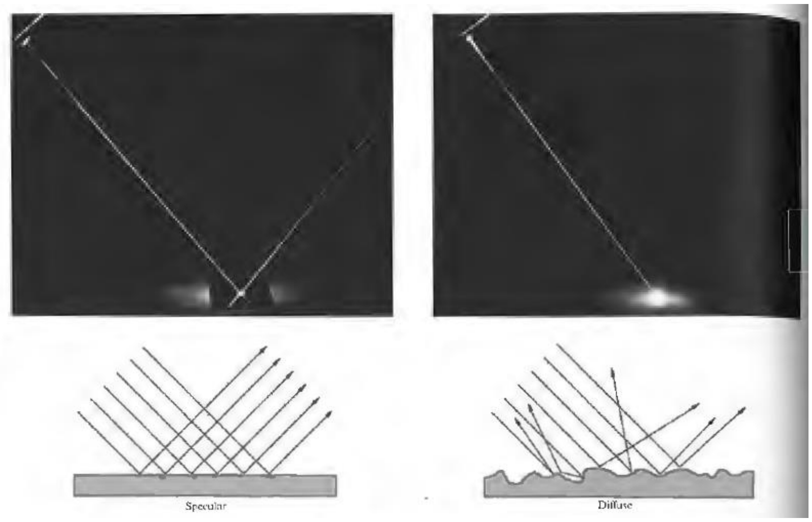
It is clear that Aizawa's and Inokawa's pulse sensors both gather data by emitting light into the user's wrist tissue, and collecting light that reflects back to the sensor from the user's tissue. *See, e.g.*, Ex. 1006, Figs. 1(b), 2 (sensor 2 has emitter 21 and four detectors 22, all facing a user's wrist 10); Ex. 1008, Figs. 1, 2 (sensor 1 has two emitters 21, 23 and one detector (photodiode 25), all facing the user's wrist when held in place by wristband 5). Dr. Kenny testifies, and Patent Owner agrees, that the

reflection of this light by the user's wrist tissue randomizes the propagation direction of the reflected light rays. *See* Ex. 1047 ¶¶ 12, 14–17, 23; Ex. 2020 ¶ 128; PO Sur-reply 7 ("Even Petitioner admits that tissue randomly scatters and absorbs light rays . . . ."). This reflection principle is illustrated by Dr. Kenny's annotations to Inokawa's Figure 2 reproduced below:



Here, Dr. Kenny has modified Inokawa's Figure 2 (1) by removing two black arrows, (2) by coloring Inokawa's light detector in red and Inokawa's two light emitters in green, and (3) by adding several green arrows to illustrate the various directions that light rays may be directed after impinging on and reflecting off different tissues in the user's wrist. Ex. 1047 ¶ 32.

This randomized direction of reflected light rays results in backscattered light that is diffuse, rather than collimated, in nature. Figure 4.12 of Exhibit 1052 illustrates the difference between diffuse and collimated light, and is reproduced below:



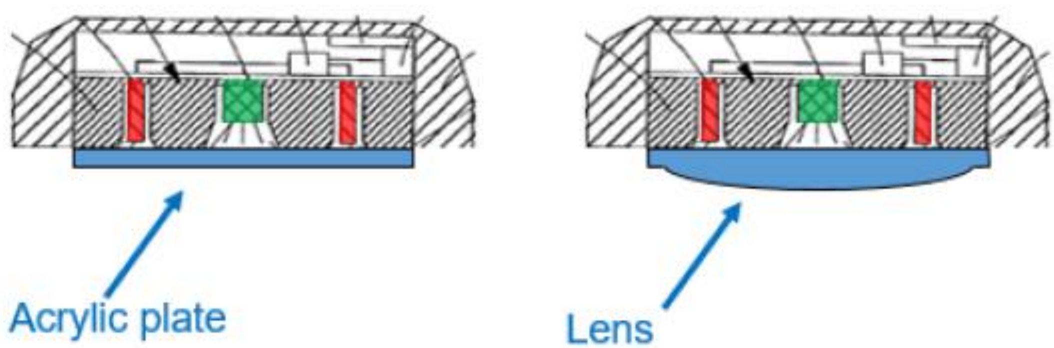
This figure provides at left a photograph and an illustration showing incoming collimated light reflecting from a smooth surface, and at right a photograph and an illustration of incoming collimated light reflecting from a rough surface. *See* Ex. 1052, 87–88. The smooth surface provides specular reflection, in which the reflected light rays are collimated like the incoming light rays. *See id.* The rough surface provides diffuse reflection, in which the reflected light rays travel in random directions. *See id.*

This diffuse nature of the light reflected from the user's wrist tissue, which both Aizawa and Inokawa aim to collect to generate pulse data, suggests that a lens might be useful to increase the amount of collected light and thereby increase the reliability of the pulse data generated using the collected light. Indeed, that is taught by Inokawa. Inokawa describes using its lens 27 to "increase the light-gathering ability" of Inokawa's light photodiode or detector 25.[7] Ex. 1008 ¶¶ 15, 58. Furthermore, there is also no dispute that Inokawa's lens 27 is understood to be shaped to include a

[7] Although Inokawa refers to the "LED" such as emitters 21, 23 in that regard (Ex. 1008 ¶ 15), rather than photodiode 25, it is undisputed that photodiode 25 is the only component of Inokawa's sensor 1 that gathers light.

single convex protruding surface. *See, e.g.*, Ex. 1003 ¶¶ 87–88 (characterizing Inokawa as teachings a "convex protrusion that acts as a lens"); PO Resp. 1 (describing Inokawa as teaching a "convex lens"). Thus, Inokawa demonstrates that it was known in the art to use a lens comprising a protrusion to focus diffuse light reflected from body tissue on to the light detecting elements of a wrist-worn pulse sensor, and to increase the light gathered by the sensor thereby improving the device's calculation of the user's pulse.

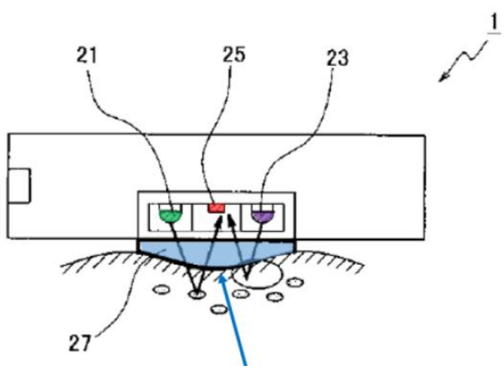
A preponderance of the evidence supports Petitioner's view that it would have been obvious for a person of ordinary skill in the art to apply Inokawa's lens technology to Aizawa's wrist-worn pulse sensor, to similarly improve its light collection as compared to Aizawa's existing flat cover. That is illustrated by the following illustrations provided by Dr. Kenny:

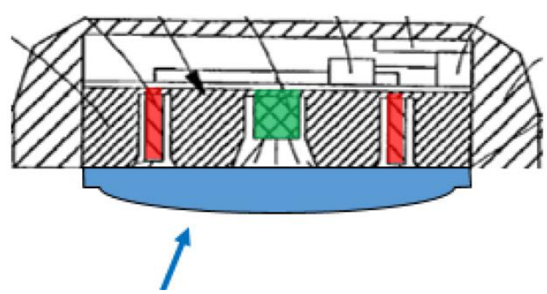


The illustration at left modifies Aizawa's Figure 1(b) to color Aizawa's emitter in green, its detectors in red, and Aizawa's existing flat cover in blue; the illustration on the right includes Aizawa's Figure 1(b) with the same color coding, but wherein the flat cover is modified to incorporate a convex protrusion that covers Aizawa's peripheral light detectors and central light emitter. *See* Ex. 1003 ¶ 89. We are persuaded by Dr. Kenny's testimony that Snell's law indicates that "light rays that may have otherwise missed the detection area are instead directed toward that area as they pass

through the interface provided by the cover," and is especially true "in configurations like Aizawa's in which light detectors are arranged symmetrically about a central light source, so as to enable backscattered light to be detected within a circular active detection area surrounding that source." Ex. 1047 ¶ 26; *see also id.* ¶¶ 23–26.

Patent Owner correctly notes that Inokawa's single detector 25 is located in the central portion of Inokawa's sensor 1, whereas Aizawa's four detectors 22 are located towards the periphery of Aizawa's sensor 2. *Compare* Ex. 1008, Fig. 2, *with* Ex. 1006, Figs. 1(a)–1(b). Nevertheless, Petitioner's proposed modification of Aizawa takes that arrangement into account, as can be seen by the following comparison between Inokawa's sensor and Petitioner's proposed modification of Aizawa's sensor:





The illustration at left annotates Inokawa's Figure 2 to identify the central detector in red and the lens in blue (*see* Ex. 1003 ¶ 87), and the illustration at right annotates Petitioner's proposed modification of Aizawa to illustrate the peripheral detectors in red and the lens in blue (*see id.* ¶ 89). As can be seen, the lenses are not identical. In Inokawa the lens's curvature is most pronounced at the center of the lens near the central detector, and in the proposed modification to Aizawa, the lens's curvature is most pronounced at the edges of the lens near the peripheral detectors. Thus, Dr. Kenny's proposed modification of Aizawa takes Inokawa's general teaching of using

a convex protrusion lens to increase the amount of incoming light directed to a light detector, and applies it to the light detectors of Aizawa. *See, e.g.*, Ex. 1003 ¶ 88 ("[B]ecause the path of light is reversible, the light collection function of Inokawa's lens would work the same way regardless of whether light is emitted toward the center (and detected by a centrally located photodiode) or emitted away from the center (and detected by a peripherally located photodiode)."), 90 ("That is, depending on the desired objective of the user (e.g., less scratches or improved light-gathering), the shape of the cover can be readily modified."), 91 ("[T]o achieve the goal of improving light collection efficiency, which both Aizawa and Inokawa share, a [person of ordinary skill in the art] would have been able to, with a reasonable expectation of success, modify Aizawa's light permeable cover to include a lens as taught by Inokawa."); Ex. 1047 ¶¶ 7–34.

We are cognizant of Patent Owner's contention that Petitioner's ground "improperly" relies upon a reference, Nishikawa, that was not identified as a part of the ground of unpatentability. PO Resp. 34. As Patent Owner observes, Dr. Kenny characterizes his testimony as being "***inspired*** by" or "motivated" in part based on Nishikawa's disclosure when it comes to the shape of a convex lens. *See, e.g.*, PO Resp. 34–35 (citing, e.g., Ex. 2007, 364:2–13; Ex. 2008, 73:8–12). We, however, disagree with Patent Owner that any impropriety arises from Dr. Kenny's contemplation of the teachings of Nishikawa in connection with the shape of a lens for a physiological sensor. The nature of Petitioner's and Dr. Kenny's consideration of Nishikawa is explained in cited portions of Dr. Kenny's declaration, even if Nishikawa is not listed as a third reference in the identification of the ground. *See* Ex. 1003 ¶ 91 ("[M]any prior art references of this period, such as Nishikawa (shown below) demonstrate exactly how

such a lens shape [as taught by Inokawa] may be incorporated into a molded cover."); Pet. 16–17. Indeed, it follows readily from the Petition that a skilled artisan would have appreciated that Nishikawa's teachings provide insight as to how "the transparent acrylic material used to make Aizawa's plate can be readily formed into a lens as in Inokawa." Pet. 16. Nishikawa describes how its "lens unit 50" can be a transparent resin formed in the shape illustrated in Figure 6 by injection molding. Ex. 1023 ¶¶ 22, 32, 35. Dr. Kenny also explains that Nishikawa's lens shape design "is intended to provide curvature in the lens where it can do the most good and otherwise try to avoid excess use of material in order to create curvature in locations where it wouldn't do any good." Ex. 2006, 179:21–180:13.

Moreover, we observe that a rejection based on obviousness "require[s] an analysis that reads the prior art in context, taking account of 'demands known to the design community,' 'the background knowledge possessed by a person having ordinary skill in the art,' and 'the inferences and creative steps that a person of ordinary skill in the art would employ.'" *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (quoting *KSR*, 550 U.S. at 418). Furthermore, record evidence can be useful to "demonstrate the knowledge and perspective one of ordinary skill in the art." *Id.*; *see also Ariosa Diagnostics v. Verinata Health Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015) ("Art can legitimately serve to document the knowledge that skill artisan would bring to bear in reading the prior art identified as producing obviousness.").

As noted above, Dr. Kenny makes clear that his view as to obviousness of the claims of the '266 patent was "inspired by" or "motivated" in part by Nishikawa's teachings as to shapes generally known to those in the art of manufacturing a lens. *See, e.g.*, Ex. 2007, 364:2–13;

Ex. 2008, 73:12–21. We conclude that the record establishes that Nishikawa's teachings are representative of background knowledge of one of ordinary skill in the art and provide context and perspective of a skilled artisan as to the type of shapes available for a convex protruding surface, such as that disclosed in Inokawa. That Dr. Kenny considered record evidence cited in the Petition as informing his view of what a skilled artisan would understand as to known types of lens shapes does not establish, in our view, any impropriety as part of that ground.

Patent Owner additionally asserts, and Dr. Madisetti testifies, that Petitioner's combination of Aizawa and Inokawa is "problematic" because it overlooks the "small" size of Aizawa's detectors 22 and the openings or cavities 23c in which they are housed. *See* PO Resp. 22 (citing Ex. 1006, Fig. 1(a); Ex. 2004 ¶ 63). Patent Owner, however, does not articulate what significance the size of Aizawa's detector components have in the obviousness evaluation based on the teachings of the prior art.

We additionally do not agree with Patent Owner's argument that Petitioner's Reply presents new arguments and evidence that should have been first presented in the Petition. The Petition proposed a specific modification of Aizawa to include a convex protrusion in the cover, for the purpose of increasing the light gathering ability of Aizawa's device. *See, e.g.*, Pet. 13–17. Patent Owner, in its Response, then challenged that contention with several arguments that Petitioner's proposed convex protrusion would not operate in the way the Petition alleged. *See, e.g.*, PO Resp. 16–37. In its Reply, Petitioner provided arguments and evidence attempting to rebut the contentions in the Patent Owner Response. *See*

PTAB Consolidated Trial Practice Guide (Nov. 2019),[8] 73 ("A party also may submit rebuttal evidence in support of its reply."). The Reply does not change Petitioner's theory for obviousness; rather, the Reply presents more argument and evidence in support of the same theory for obviousness presented in the Petition. *Compare* Pet. 13–17, *with* Pet. Reply 2–15.

Patent Owner finally argues that a conclusion of obviousness "strains credibility" because the level of ordinary skill in the art (*see supra* Section II.C) does not require specific education or experience with optics or optical physiological monitors. *See, e.g.*, PO Resp. 31–32. We disagree. Concerning motivation, an ordinarily skilled artisan would have readily appreciated from the record at hand that: (1) Aizawa's detector 1 operates by gathering light data with its photodetectors 22; (2) a lens was known to focus the light on photodetectors; and (3) optical lenses may be formed by providing a convex protrusion in the lens to focus light. Indeed, Inokawa discloses such utility, function, and structure as a part of its convex lens. *See, e.g.*, Ex. 1008 ¶¶ 15, 58, Fig. 2. We are persuaded that a person of ordinary skill in the art would have understood these general concepts of optics.

Concerning reasonable expectation of success, we rely on Dr. Kenny's testimony that a person of ordinary skill in the art would have "would have sought to incorporate a convex, lens structure as in Inokawa into Aizawa's acrylic plate to thereby increase light collection efficiency, in turn leading to more reliable pulse wave detection," "would have further understood *how* to" do so, "depending on the desired objective of the user,"

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[8] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

and would have enjoyed a reasonable expectation of success in doing so. Ex. 1003 ¶¶ 88, 90–91; Ex. 2006, 179:21–180:13, 202:11–20.

Thus, we conclude that one of ordinary skill in the art would have had adequate reason to replace Aizawa's flat cover 6 with a cover comprising a convex protrusion, to improve light detection efficiency, and would have had a reasonable expectation of success in doing so.

vi. Summary

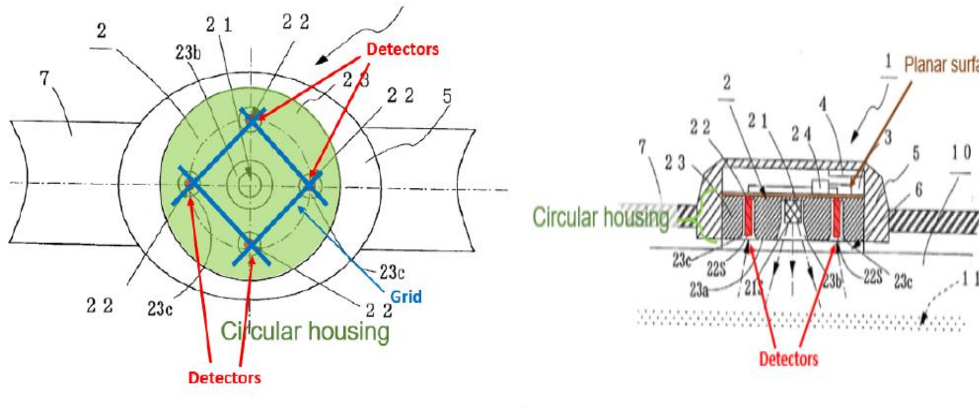
For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

4. Independent Claim 9

Independent claim 9 consists of limitations that are substantially similar to limitations [a]–[d] of claim 1. *Compare* Ex. 1001, 44:37–54, *with id.* at 45:13–23 (reciting "a housing" as opposed to "a circular housing including a planar surface"; "at least four detectors" as opposed to "at least four detectors arranged on the planar surface" and "the four detectors are arranged in a grid pattern"; "a lens" as opposed to "a lens forming a cover" and omitting details of the lens' location; the sensor is "worn by the user" as compared to omitting details regarding user wear).

In asserting that claim 9 also would have been obvious over the combined teachings of Aizawa and Inokawa, Petitioner refers to the same arguments presented as to claim 1 (Pet. 35–36, 39 ("*See supra* Ground 1A")) and also presents additional arguments corresponding to the claimed "circular housing," "planar surface," and "grid pattern" limitations (Pet. 36–39). Specifically, Petitioner presents modified and annotated Figures 1(a)

and (1b) of Aizawa (reproduced below) to demonstrate the claimed circular housing and planar surface.



Annotated Figure 1(a) (left) depicts pulse wave sensor 2 comprising holder 23 with detectors 22 arranged in a standard north, south, east, west grid pattern (depicted in blue). Pet. 38. The circular shape of the holder is highlighted in green. *Id*. Annotated Figure 1(b) (right) depicts pulse wave sensor 2 comprising holder 23 (labeled in green text as "Circular housing"). Pet. 36. The holder is adjacent to a surface, highlighted in brown, that Petitioner equates to the claimed "planar surface." *Id*.

Patent Owner does not present any argument for these claims other than those we have already considered with respect to independent claim 1 and our claim construction analysis above. PO Resp. 12–43.

For the same reasons discussed above, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 9 would have been obvious over the cited combination of references. *See supra* II.D.3.i–v; Ex. 1003 ¶¶ 106–113.

5. Dependent Claims 2–6, 8, 10–16, 18, and 19

Petitioner presents undisputed contentions that claims 2–6, 8, 10–16, 18, and 19, which depend directly or indirectly from independent claim 1 or

9, are unpatentable over the combined teachings of Aizawa and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 30–35, 39–44; Ex. 1003 ¶¶ 94–105, 114–124.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1. PO Resp. 43 ("The Petition fails to establish that independent claims 1 and 9 would have been obvious . . . and thus fails to establish obviousness as to any of the challenged dependent claims.") (citing Ex. 2004 ¶ 89).

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–6, 8, 10–16, 18, and 19 would have been obvious over the combined teachings of the cited references and as supported by the testimony of Dr. Kenny.

E. Obviousness over the Combined Teachings of Mendelson-1988 and Inokawa

Petitioner contends that claims 1–6, 8–16, 18, and 19 of the '266 patent would have been obvious over the combined teachings of Mendelson-1988 and Inokawa. Pet. 47–71.

1. Overview of Mendelson-1988 (Ex. 1015)

Mendelson-1988 discloses a pulse oximeter, with an optical reflectance sensor suitable for noninvasive monitoring of a user's arterial hemoglobin oxygen saturation (SpO_2), via the user's forehead. *See* Ex. 1015, 167 (title & abstract). Figure 2 is reproduced below:

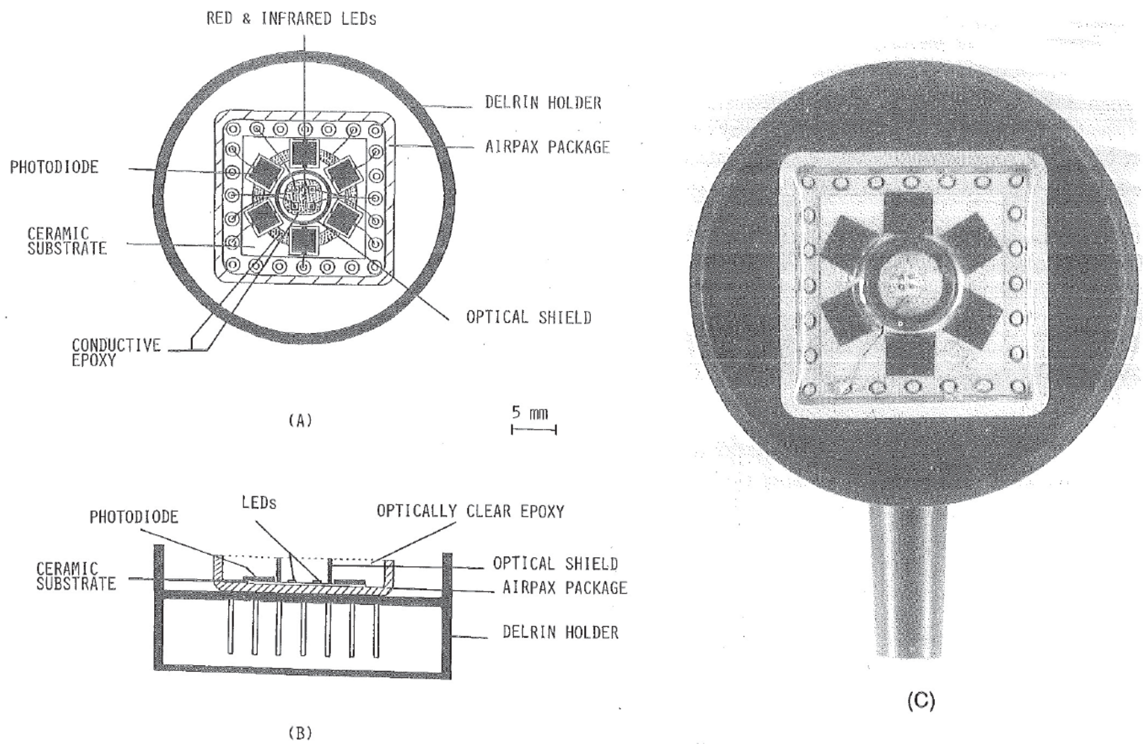


Figure 2 illustrates the sensor of Mendelson-1988, including: (A) a top view diagram; (B) a side view diagram; and (C) a photograph. *Id.* at 169.

The sensor includes two red LEDs and two infrared LEDs for emitting light into the user's tissue, and six photodiodes "arranged symmetrically in a hexagonal configuration" surrounding the four emitters, to detect light reflected back to the sensor from the user's tissue. *Id.* at 168 ("SENSOR DESIGN"). The user's "SpO_2 can be calculated from the ratio of the reflected red and infrared photoplethysmograms." *Id.* at 167. "To minimize the amount of light transmission and reflection between the LEDs and the photodiodes within the sensor, a ring-shaped, optically opaque shield of black Delrin . . . was placed between the LEDs and the photodiode chips." *Id.* at 168 (col. 2). "The optical components were encapsulated inside the package using optically clear adhesive." *Id.* "The microelectronic package was mounted inside a black Delrin housing." *Id.*

2. Independent Claim 1

i. "A noninvasive optical physiological sensor comprising"

The cited evidence supports Petitioner's undisputed contention that Mendelson-1988 discloses a noninvasive optical physiological sensor, i.e., an "optical reflectance sensor" that monitors "arterial hemoglobin oxygen saturation [SpO_2]," a physiological parameter of the wearer. Pet. 52; *see, e.g.*, Ex. 1015, Abstract, 167, 172; Ex. 1003 ¶ 130.

ii. "[a] a plurality of emitters configured to emit light into tissue of a user"

The cited evidence supports Petitioner's undisputed contention that Mendelson-1988 discloses two red LEDs and two infrared LEDs that emit light into user tissue. Pet. 52–53; *see, e.g.*, Ex. 1015, 168 ("The optical reflectance sensor used in this study consists of two red (peak emission wavelength: 660 nm) and two infrared (peak emission wavelength: 930 nm) LED chips.")), Fig. 2(a); Ex. 1003 ¶ 131.

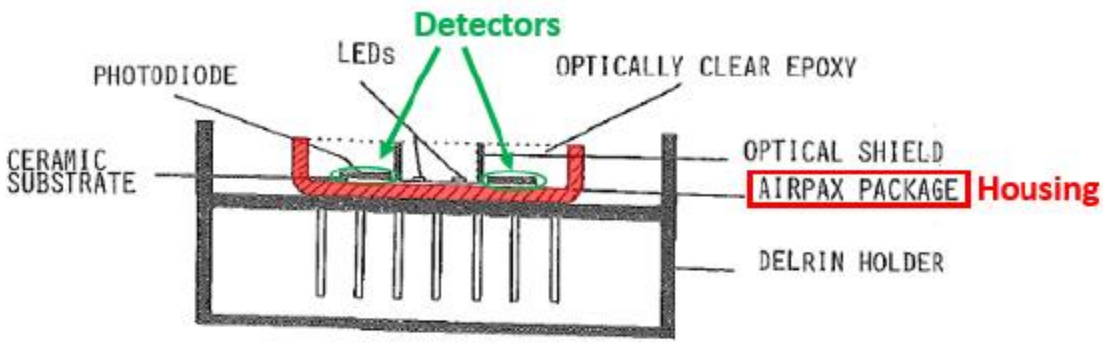
iii. "[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors"

The cited evidence supports Petitioner's undisputed contention that Mendelson-1998 discloses "six silicon photodiodes . . . arranged symmetrically in a hexagonal configuration" on the sensor. Pet. 53–54; *see, e.g.*, Ex. 1015, 168–169, Figs. 2(A)–(B). Mendelson-1998 discloses that the photodiodes output "current pulses" indicative of a physiological parameter of the wearer in response to light emitted by the emitters and reflected from the skin. Pet.52; *see, e.g.*, Ex. 1015, 167 ("SpO_2 can be calculated from the

ratio of the reflected red and infrared photoplethysmograms.”); Ex. 1003 ¶ 132.

> iv. *“[c] a housing configured to house at least the plurality of detectors”*

The cited evidence supports Petitioner’s contention that Mendelson-1988 discloses an AIRPAX package, i.e., a housing in which the detectors are located. Pet. 54; Ex. 1015, 168. Petitioner’s annotated version of Mendelson-1988’s Figures 2B is reproduced below.



Pet. 54. The modified figure depicts a side view of Mendelson-1988’s sensor with a housing (depicted in red) in which the detectors (depicted in green) are located. *Id.*; Ex. 1003 ¶ 133.

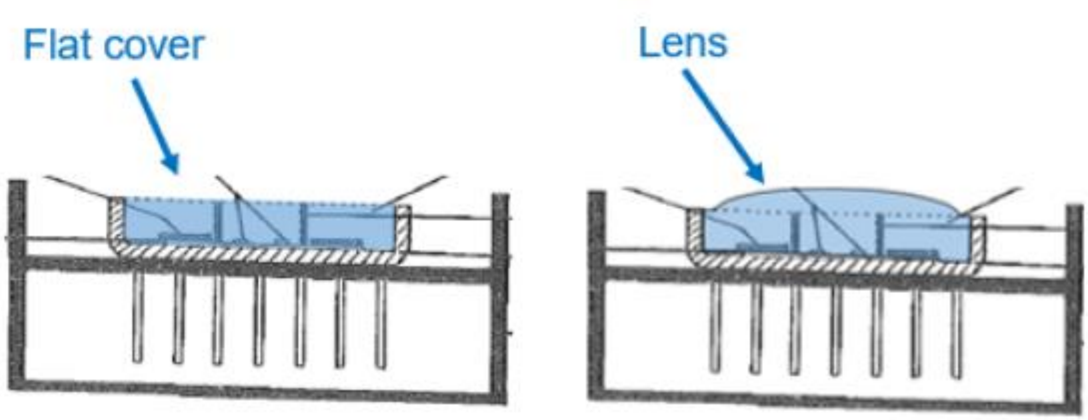
> v. *“[d] a lens configured to be located between the tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological*

sensor worn by the user and during operation of the noninvasive optical physiological sensor."

Petitioner's Contentions

Petitioner contends that Mendelson-1988's sensor discloses a light permeable cover, i.e., the "OPTICALLY CLEAR EPOXY" in Figure 2B, that covers the detectors and is located between the user's tissue and the detectors when worn. Pet. 47–48, 55–56; Ex. 1003 ¶¶ 67, 134–143. Petitioner states that Mendelson-1998 does not provide further details, such as the "precise shape of this layer's interface with the skin." Pet. 48–49; Ex. 1003 ¶ 135. As discussed above in Section II.D.3, Petitioner contends that Inokawa's sensor includes lens 27 positioned over light detector 25. Pet. 49. Petitioner reasons that an ordinarily skilled artisan would have been motivated, with a reasonable expectation of success, to modify Mendelson-1988's optical SpO_2 sensor, in light of Inokawa's optical pulse sensor, by adding a lens with a single outwardly protruding convex surface to Mendelson-1988's cover to improve the sensor's light detection efficiency. *Id.* at 49–50.

Dr. Kenny provides the following illustrations to portray the proposed modification of Mendelson-1988's sensor (Ex. 1003 ¶¶ 138–139):



At the left, Dr. Kenny has excerpted and annotated Mendelson-1988's Figure 2B, to identify the pre-existing cover (colored blue) which covers the light emitters and detectors. *See id.* At the right, Dr. Kenny has illustrated the device resulting from the proposed modification of the cover to have a single convex protrusion (also colored blue). *See id.*

Petitioner adds that a person of ordinary skill in the art would have had a reasonable expectation of success in implementing Inokawa's lens structure in Mendelson-1998, and that the modification would have "require[d] only routine knowledge of sensor design and assembly." Pet. 51; Ex. 1003 ¶ 140. For example, Petitioner contends that prior art such as Nishikawa[9] demonstrates that "molding clear epoxy, as in Mendelson-1988, into a lens was well understood." Pet. 51 (citing Ex. 1023, Fig. 6, ¶¶ 22, 32, 35; Ex. 1003 ¶ 141). Indeed, Petitioner notes that Mendelson-1998 and Nishikawa utilize the same material, which "can have the same index of refraction, and, as such, the interface between the encapsulation portion and the lens portion will not adversely affect the optical performance of the modified system." *Id.* at 51–52 (citing Ex. 1023 ¶ 37; Ex. 1003 ¶ 142).

Finally, Petitioner contends that "[a]ttaching a rigid device," as suggested by the proposed combination of Mendelson-1998 and Inokawa, "in such a manner will cause at least some deformation of the tissue to occur because the skin is more pliable than the cover," such that the modified sensor and lens "acts to further deform the tissue of the user around the convex surface of the lens when the device is pressed against the tissue." Pet. 56; Ex. 1003 ¶ 143.

[9] U.S. Patent Application Publication No. 2007/0145255 A1, filed Dec. 20, 2006, published June 28, 2007 (Ex. 1023).

Patent Owner's Arguments

Patent Owner is of the view that Petitioner has not met its burden to demonstrate the obviousness of modifying Mendelson-1988's sensor in light of Inokawa to have a protrusion, based on substantially the same analysis and testimony discussed above in the context of combining Aizawa and Inokawa. *See* PO Resp. 47–51; Ex. 2004 ¶¶ 98–109; *supra* Section II.D.3.v. For example, Patent Owner argues that Mendelson-1988, like Aizawa, provides central emitters surrounded by several peripherally located detectors. *Compare* Ex. 1015, 169 (Fig. 2) (showing four central LEDs surrounded by six photodiodes), *with* Ex. 1006, Figs. 1(a)–1(b) (showing one central LED 21 surrounded by four photodetectors 22); PO Resp. 47. Given this arrangement, Patent Owner reiterates its argument that the proposed combination in view of Inokawa would direct light away from the peripheral detectors, and toward the center of the sensor, thereby diminishing the received signal. PO Resp. 49–51.

Additionally, and as discussed above in the context of combining Aizawa and Inokawa, Patent Owner argues that Petitioner improperly relies upon Nishikawa's teachings, although Nishikawa is not identified as part of the asserted ground of unpatentability. PO Resp. 55–57.

Petitioner's Reply

Petitioner incorporates its contentions as set forth regarding the proposed combination of Aizawa and Inokawa, and responds that Dr. Kenny's consideration of Nishikawa was proper, as providing further support for the proposed combination. Pet. Reply 22–23, 26–27.

Patent Owner's Sur-reply

Patent Owner's Sur-reply generally reiterates its arguments challenging Petitioner's contentions. PO Sur-reply 20–24.

Analysis

As an initial matter, we find that a preponderance of the evidence establishes that the Mendelson-1988 sensor's optically clear epoxy is a light permeable cover that is arranged above a portion of the housing and covers the sensor's detectors. In particular, it is clear from Figures 2A and 2B that the epoxy extends from the top of the sensor at the dotted line in the figure, down into the well of the AIRPAX package, to cover all four LEDs and all six photodiodes disposed at the bottom of the well. *See also* Ex. 1015, 168 ("The optical components were encapsulated inside the package using optically clear adhesive").

We also conclude that a preponderance of the evidence supports Petitioner's contention that it would have been obvious to modify the top surface of Mendelson-1988's cover to include a lens including a single convex protruding surface, in order to increase the amount of backscattered light that will be received by Mendelson-1988's peripheral detectors. Our reasoning is substantially identical to the analysis provided above in connection with the ground based on Aizawa and Inokawa, with Mendelson-1988 replacing Aizawa in the combination. *See supra* Section II.D.3. Patent Owner does not cite, and we do not discern, any material difference between Mendelson-1988 and Aizawa that might lead to a different result here. For the reasons discussed in Section II.D.3, we do not agree with Patent Owner's arguments that the proposed combination

would result in a diminished sensor signal, or that Petitioner improperly relied upon Nishikawa.

vi. Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

3. Independent Claim 9

Independent claim 9 consists of limitations that are substantially similar to limitations [a]–[d] of claim 1. *Compare* Ex. 1001, 44:37–54, *with id.* at 45:13–23 (reciting "a housing" as opposed to "a circular housing including a planar surface"; "at least four detectors" as opposed to "at least four detectors arranged on the planar surface" and "the four detectors are arranged in a grid pattern"; "a lens" as opposed to "a lens forming a cover" and omitting details of the lens' location; the sensor is "worn by the user" as compared to omitting details regarding user wear).

Petitioner's Contentions

With respect to the "circular housing having a planar surface" requirement, Petitioner points to Mendelson's Figures 2(A) and 2(B) and contends that "Mendelson-1988 discloses that its LEDs and photodiode chips (i.e., emitters and detectors) are mounted on a ceramic substrate (***planar surface***) and housed within an AIRPAX microelectronic package (***housing***)." Pet. 64. Petitioner, however, characterizes the housing shown in those figures, specifically Figure 2(A) as "appear[ing] to have a square shape, not a circular one." *Id.* Petitioner reasons that "[a person of ordinary skill in the art] would have recognized that microelectronic packaging as

used in Mendelson-1988 comes in various shapes and sizes" and "[a person of ordinary skill in the art] would have considered using a differently shaped housing, namely a circular one, to be obvious." *Id.* at 64–65 (citing Ex. 1003 ¶ 162). Petitioner also contends that employing a circular housing was "common practice" prior to the '266 patent, and that "there was nothing new or inventive about changing one housing shape for another." *Id.* at 65 (citing Ex. 1003 ¶ 162). Petitioner explains that its contentions are evidenced by another reference of record, Mendelson '799. *Id.*

<u>Patent Owner's Arguments</u>

Patent Owner characterizes Petitioner's proposed ground for claim 9 as "facially deficient" for several reasons: (1) "[t]he Petition never identifies a motivation to pick a circular-shaped housing instead of the existing square shape"; (2) "[a person of ordinary skill in the art] would have no particular motivation to change the shape unless a [person of ordinary skill in the art] perceived some benefit in doing so"; (3) "Mendelson '799 does not disclose a cover (or even epoxy encapsulation) and thus cannot disclose a circular housing and a cover of the circular housing, as claim 9 requires"; and (4) "Petitioner did not include Mendelson '799 in any ground." PO Resp. 53–55 (citing Ex. 2004 ¶¶ 118–119).

<u>Petitioner's Reply</u>

In response to Patent Owner's arguments, Petitioner replies that "references like Mendelson [']799 have a circular housing and confirm the notion that a [person of ordinary skill in the art] would have found it to be simply a matter of design choice to use different shapes." Pet. Reply 25–26 (citing Ex. 1003 ¶¶ 160–162; Ex. 1025, Fig. 7, 9:34–36; Ex. 1047 ¶ 53).

Petitioner also contends "neither the '266 patent nor [Patent Owner] provides any explanation of how the particular housing shape solves some problem or presents some unexpected result." *Id.* at 26 (citing *In re Kuhle*, 526 F.2d 553, 555 (CCPA 1975)).

Patent Owner's Sur-reply

Patent Owner responds that "Petitioner's reply reiterates its conclusory arguments that [the proposed] change would be routine, without identifying any reason to modify the shape from square to circular." Sur-reply 23.

Analysis

As noted above, we find that a preponderance of the evidence establishes that the Mendelson-1988 sensor's optically clear epoxy is a light permeable cover that is arranged above a portion of the housing and covers the sensor's detectors.[10] In particular, it is clear from Figures 2A and 2B that the epoxy extends from the top of the sensor at the dotted line in the figure, down into the well of the AIRPAX package, to cover all four LEDs and all six photodiodes disposed at the bottom of the well. *See also* Ex. 1015, 168 ("The optical components were encapsulated inside the package using optically clear adhesive.").

We also conclude that a preponderance of the evidence supports Petitioner's contention that it would have been obvious to modify the top surface of Mendelson-1988's epoxy to include a lens including a single convex surface, in order to increase the amount of backscattered light that will be received by Mendelson-1988's peripheral detectors. Our reasoning

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[10] We note that claim 1 does not recite a "cover." *See supra* § II.A.1.

is substantially identical to the analysis provided above in connection with the ground based on Aizawa and Inokawa, with Mendelson-1988 replacing Aizawa in the combination. *See supra* Section II.D.3. Patent Owner does not cite, and we do not discern, any material difference between Mendelson-1988 and Aizawa that might lead to a different result here. For the reasons discussed in Section II.D.3, we do not agree with Patent Owner's arguments that the proposed combination would result in a diminished sensor signal, or that Petitioner improperly relied upon Nishikawa.

Further, we determine that a preponderance of the evidence supports Petitioner's contention that it would have been obvious to modify the shape of Mendelson-1988's AIRPAX package from square to circular. Petitioner's and Dr. Kenny's general assessment that a person of ordinary skill in the art would have been aware that a circular housing shape was a known option for housing of components of a physiological sensor finds support in the record. Pet. 64–65; Ex. 1003 ¶¶ 161–162. In that respect, although Mendelson '799 was not listed in the styling of the proposed grounds of unpatentability based on Mendelson-1988 and Inokawa, its teachings plainly were offered in the Petition as evidence of the background knowledge that an ordinarily skilled artisan would have brought to bear in an evaluation of the teachings Mendelson-1988 and Inokawa. Pet. 64–65. Moreover, it is clear that Patent Owner understood that the proposed ground offered in the Petition took into account the disclosure of Mendelson '799, and Patent Owner had opportunity to address that disclosure. Indeed, Patent Owner availed itself of that opportunity during trial (*see, e.g.*, PO Resp. 53–55; Sur-reply 23–24).

We further find unavailing Patent Owner's argument that "Mendelson '799 does not disclose a cover (or even epoxy encapsulation) and thus cannot disclose a circular housing and a cover of the circular housing, as

claim 9 requires." PO Resp. 55. Figure 7 of Mendelson '799 is reproduced below:

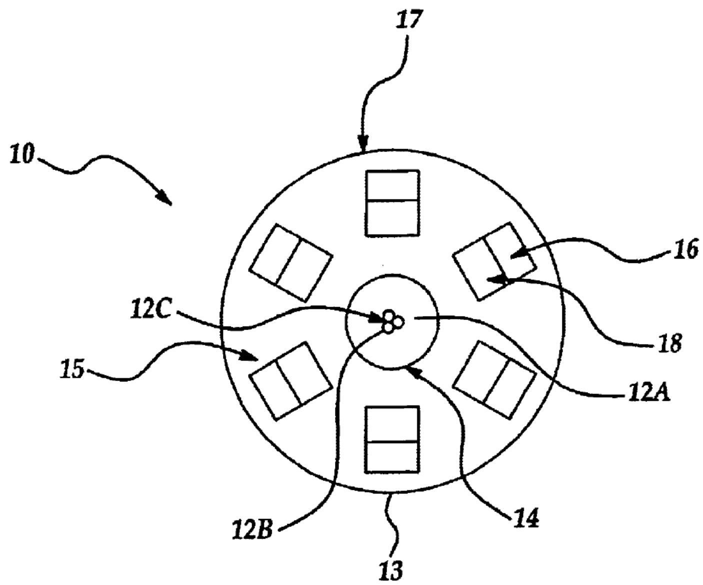

Figure 7

Figure 7 is a top view of optical sensor 10 comprising light source 12 composed of three LEDs 12A, 12B, and 12C emitting light of three different wavelengths, and an array of six near detectors 18 and six far detectors 16 "arranged in two concentric ring-like arrangements" surrounding light source 12. Ex. 1025, 9:23–34. "All these elements are accommodated in a sensor housing 17" which, as can be seen in Figure 7, is clearly circular. *Id.* at 9:34–35. Patent Owner does not articulate why the presence or absence of a cover in Mendelson '799 somehow serves to discount Mendelson '799's unambiguous presentation of a sensor housing having a shape recognizable as circular.

Furthermore, one of ordinary skill in the art would have understood that the AIRPAX package of Mendelson-1988 and the housing 17 of Mendelson '799 are performing the same function of enclosing a central collection of light emitters which are surrounded by an array of light

detectors in an optical sensor attached to a user's body. *See, e.g.*, Ex. 1015, Figs. 2A–2B; Ex. 1025, Fig. 7. The evidence of record also does not suggest that the shape of such a housing has any functional significance in the operation of the optical sensor, or that any particular known shape was preferred or restricted. Thus, the evidence suggests that a square shape and a circular shape of such as housing were known in the art to be predictable substitutes for one another, and therefore obvious variants. *See, e.g.*, *KSR*, 550 U.S. at 416 ("[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result."); *id.* at 417 ("[W]hen a patent 'simply arranges old elements with each performing the same function it had been known to perform' and yields no more than one would expect from such an arrangement, the combination is obvious." (citation omitted)).

We conclude Petitioner has demonstrated by a preponderance of the evidence that Petitioner's ground based on Mendelson-1988 and Inokawa conveys the unpatentability of claim 9.

4. Dependent Claims 2–6, 8, 10–16, 18, and 19

Petitioner presents undisputed contentions that claims 2–6, 8, 10–16, 18, and 19, which depend directly or indirectly from independent claim 1 or 9, are unpatentable over the combined teachings of Mendelson-1988 and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 56–63, 67–71; Ex. 1003 ¶¶ 144–157, 166–175.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1.

PO Resp. 57 ("The Petition fails to establish that independent claims 1 and 9 are obvious . . . and therefore fails to establish obviousness of any of the challenged dependent claims.").

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–6, 8, 10–16, 18, and 19 would have been obvious over the combined teachings of the cited references and as supported by the testimony of Dr. Kenny.

F. Obviousness over the Combined Teachings of Aizawa, Inokawa, and Ohsaki

Petitioner contends that claims 1–6, 8–16, 18, and 19 of the '266 patent would have been obvious over the combined teachings of Aizawa, Inokawa, and Ohsaki. Pet. 44–46.

Because we have already determined that these claims are unpatentable based on Aizawa and Inokawa, and Mendelson-1988 and Inokawa, which is dispositive as to all challenged claims, we need not reach this additional ground. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) ("[T]he Board need not address issues that are not necessary to the resolution of the proceeding."); *see supra* §§ II.D–E.

III. CONCLUSION

In summary:[11]

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–6, 8–16, 18, 19	103	Aizawa, Inokawa	1–6, 8–16, 18, 19	
1–6, 8–16, 18, 19	103	Mendelson-1988, Inokawa	1–6, 8–16, 18, 19	
1–6, 8–16, 18, 19	103[12]	Aizawa, Inokawa, Ohsaki		
Overall Outcome			1–6, 8–16, 18, 19	

[11] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

[12] As explained above, because we conclude that the challenged claims are unpatentable on other grounds, we do not reach the merits of this ground.

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 1–6, 8–16, 18, and 19 of the ’266 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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CERTIFICATE OF SERVICE

I hereby certify that the original of this Notice of Appeal was filed via U.S.P.S. Priority Mail Express on July 27, 2022 with the Director of the United States Patent and Trademark Office at the address below:

Office of the Solicitor
United States Patent and Trademark Office
Mail Stop 8, P.O. Box 1450
Alexandria, Virginia 22313-1450

A copy of this Notice of Appeal is being filed and served on July 27, 2022 as follows:

To the USPTO Patent Trial and Appeal Board:
Patent Trial and Appeal Board
Madison Building East
600 Dulany Street
Alexandria, VA 22313

(*via PTABe2e – as authorized by the Board*)

To the U.S. Court of Appeals for the Federal Circuit:
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Paper 32
Date: May 25, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00209
Patent 10,376,191 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges*.

WIEKER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

Case: 22-2069 Document: 21-4 Page: 258 Filed: 09/16/2022

I. INTRODUCTION

A. Background

Apple Inc. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–6, 8–16, 18, and 19 (“challenged claims”) of U.S. Patent No. 10,376,191 B1 (Ex. 1001, “the ’191 patent”). Paper 2 (“Pet.”). Masimo Corporation (“Patent Owner”) waived filing a preliminary response. Paper 6. We instituted an *inter partes* review of all challenged claims 1–6, 8–16, 18, and 19 on all grounds of unpatentability, pursuant to 35 U.S.C. § 314. Paper 7 (“Inst. Dec.”).

After institution, Patent Owner filed a Response (Paper 15, “PO Resp.”) to the Petition, Petitioner filed a Reply (Paper 18, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 22, “PO Sur-reply”). An oral hearing was held on March 15, 2022, and a transcript of the hearing is included in the record. Paper 31 (“Tr.”).

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, Petitioner has met its burden of showing, by a preponderance of the evidence, that challenged claims 1–6, 8–16, 18, and 19 of the ’191 patent are unpatentable.

B. Related Matters

The parties identify the following matters related to the ’191 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00193 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,299,708 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00195 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,190 B1); and

Apple Inc. v. Masimo Corporation, IPR2021-00208 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,258,266 B1).

Pet. 71–72; Paper 3, 3–4.

Patent Owner further identifies the following pending patent applications, among other issued and abandoned applications, that claim priority to, or share a priority claim with, the ’191 patent:

U.S. Patent Application No. 16/834,538;

U.S. Patent Application No. 17/031,407;

U.S. Patent Application No. 17/031,316;

U.S. Patent Application No. 17/031,356;

U.S. Patent Application No. 16/449,143; and

U.S. Patent Application No. 16/805,605.

Paper 3, 1–3.

C. The ’191 Patent

The ’191 patent is titled “Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents,” and issued on August 13,

2019, from U.S. Patent Application No. 16/409,515, filed May 10, 2019. Ex. 1001, codes (21), (22), (45), (54). The ’191 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The ’191 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:35–37. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:26–32, 61–62. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:42–45.

Figure 1 of the ’191 patent is reproduced below.

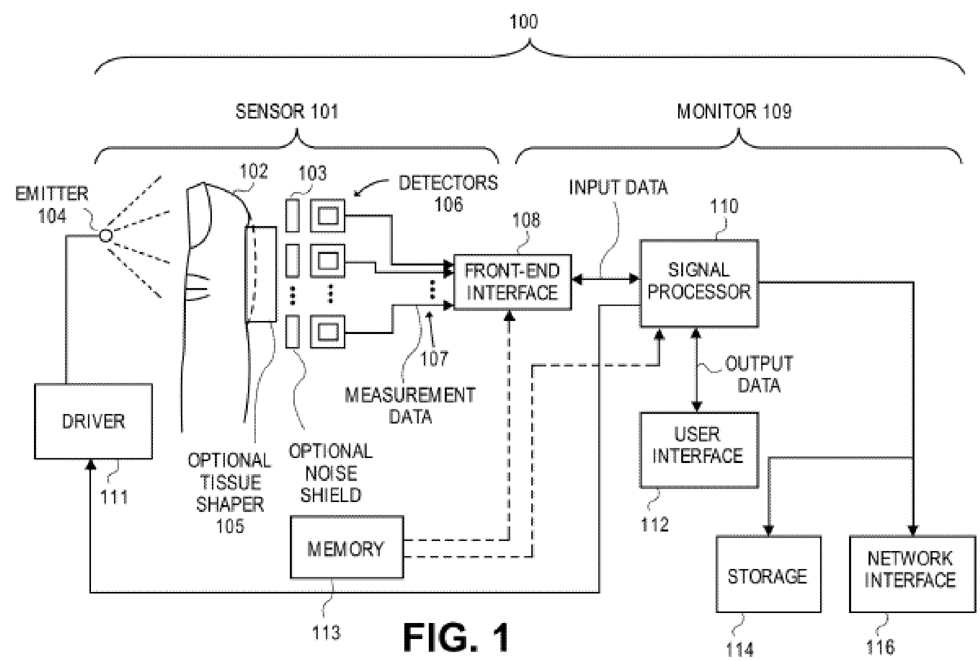


FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:42–44. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:54–56. Emitters 104 emit light that

is attenuated or reflected by the patient's tissue at measurement site 102. *Id.* at 13:67–14:3. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 14:3–6, 14:22–28. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:57–11:9.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:12–14. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:17–20. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:42–55. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:56–62.

The '191 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate detector portions of sensor devices.

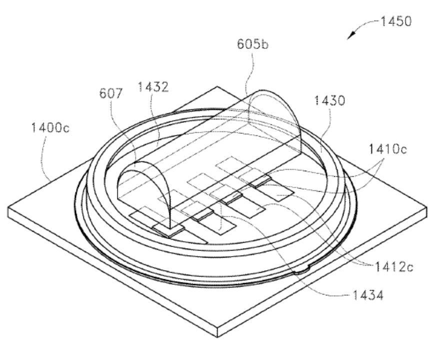


FIG. 14D

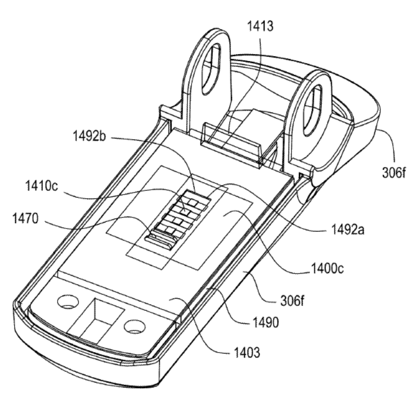


FIG. 14F

Figure 14D illustrates portions of a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:40–43. As shown in

Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:36–40, 36:30–37. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 37:9–17. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* at 37:18–25. Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:47–49.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

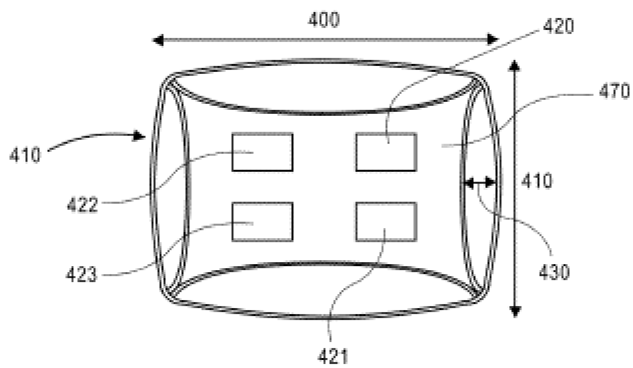


FIG. 4A

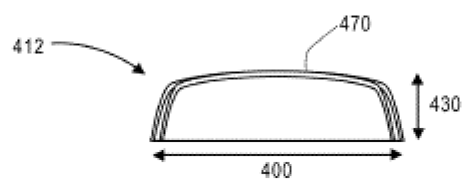


FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:13–19. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:36–38. The measurement site contact area may include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:44–58.

D. Illustrative Claim

Of the challenged claims, claims 1 and 9 are independent. Claim 1 is illustrative and is reproduced below.

1. A noninvasive optical physiological sensor comprising:

[a] a plurality of emitters configured to emit light into tissue of a user;

[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors;

[c] a housing configured to house at least the plurality of detectors in a circular portion of the housing; and

[d] a lens configured to be located between tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor is worn by the user and during operation of the noninvasive optical physiological sensor.

Ex. 1001, 44:50–67 (bracketed identifiers [a]–[d] added). Independent claim 9 includes limitations similar to limitations [a]–[d] of claim 1. *Id.* at 45:26–36 (reciting a "planar surface"; "at least four detectors" arranged in a "grid pattern" on the planar surface; and "a lens forming a cover of the housing").

E. Applied References

Petitioner relies upon the following references:

Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");

Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");

Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[1] and

Y. Mendelson et al., "Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Association for the Advancement of Medical Instrumentation, Vol. 22, No. 4, 167–173 (1988) (Ex. 1015, "Mendelson-1988").

Pet. 3. Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003), and the Second Declaration of Thomas W. Kenny (Ex. 1047). Patent Owner submits, *inter alia*, the Declaration of Vijay K. Madisetti, Ph.D. (Ex. 2004). The parties also provide deposition testimony from Dr. Kenny and Dr. Madisetti, including from this and other proceedings. *See* Exs. 1034–1036, 2006–2009, 2020, 2027.

F. Asserted Grounds

Petitioner asserts that claims 1–6, 8–16, 18, and 19 are unpatentable based upon the following grounds:

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–6, 8–16, 18, 19	103	Aizawa, Inokawa
1–6, 8–16, 18, 19	103	Aizawa, Inokawa, Ohsaki
1–6, 8–16, 18, 19	103	Mendelson-1988, Inokawa

[1] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). In this Decision, we also refer to the translation.

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019).

Although both parties contend that no claim term requires express construction (Pet. 3–4; PO Resp. 9), the substance of the parties' briefing demonstrates that there is a dispute regarding the claim term "cover."

1. "cover"

Independent claim 9 requires "a lens forming a cover of the housing." Ex. 1001, 45:27–46:3. Although independent claim 1 also recites "a lens," it does not recite a "cover." *Id.* at 44:50–67.

Patent Owner argues that the claimed "cover" excludes "an optically clear adhesive/epoxy" and a "resin on a surface." PO Resp. 51. According to Patent Owner, "the '191 Patent distinguishes a resin on a surface from a cover, explaining: 'the cylindrical housing 1430 (and transparent cover 1432) . . . can protect the detectors 1410c and conductors 1412c ***more effectively*** than currently-available ***resin epoxies***.'" *Id.* (quoting Ex. 1001, 36:37–46).

Patent Owner alleges that Dr. Kenny also "distinguished a sealing resin from a cover, acknowledging a 'layer of sealing resin' is 'one way to protect the components ***without using a cover***.'" *Id.* at 51–52 (quoting Ex. 2009, 395:22–396:17). Patent Owner argues its understanding is

consistent with the prior art cited by Petitioner. *Id.* at 52 (citing Ex. 1008 ¶ 103, Fig. 17; Ex. 1023 ¶ 35; Ex. 2004 ¶ 113).

Petitioner replies that "there is nothing in the specification or the prosecution history [of the '191 patent] that would lead a [person of ordinary skill in the art] to conclude that 'cover' should be interpreted based on anything other than its plain meaning." Pet. Reply 24 (citing *Thorner v. Sony Computer Entertainment America LLC*, 669 F.3d 1362, 1368 (Fed. Cir. 2012)). That plain meaning, according to Petitioner, is that "a cover is merely 'something that protects, shelters, or guards.'" *Id.* (quoting Ex. 1050; Ex. 1047 ¶ 48). Petitioner argues that Patent Owner's reliance on the '191 patent Specification takes text out of context and, when context is considered, it is clear that "the epoxy resin to which the '191 patent compares its cover is not [an] epoxy cover . . . but rather epoxy that is applied to solder joints." *Id.* at 24–25 (citing Ex. 1001, 36:50–59; Ex. 1047 ¶ 50).

Petitioner also contends that Patent Owner "mischaracterizes Dr. Kenny's deposition testimony to say he agreed that 'sealing resin' is somehow distinguished from a cover." *Id*. at 24. Petitioner contends that Dr. Kenny simply "clarified that using a sealing resin is 'a pretty common way to protect electronic components.'" *Id.* (citing Ex. 2009, 395:22–396:8; Ex. 1047 ¶ 49). Moreover, Petitioner contends that "such extrinsic evidence would not justify departure from plain meaning under *Thorner*." *Id.*

In its Sur-reply, Patent Owner maintains that the '191 patent "specifically ***distinguishes*** a 'resin' on a surface from a 'cover,'" and Petitioner's opposing reading is not persuasive. PO Sur-reply 20–21.

Upon review of the record, we disagree with Patent Owner's limiting construction of "cover" to exclude epoxy and resin. The plain and ordinary meaning of the term does not support Patent Owner's view. A "cover" ordinarily connotes "something that protects, shelters, or guards." Ex. 1050 (*Merriam-Webster's Collegiate Dictionary*, 11th ed. (©2005)), 288. That plain and ordinary meaning is consistent with the '191 patent's description of "flex circuit cover 360, which can be made of plastic or another suitable material . . . [and] can cover and thereby protect a flex circuit (not shown)." Ex. 1001, 22:66–23:2. It is also consistent with the '191 patent's description and illustration of "transparent cover 1432" in Figure 14D, which covers and protects detectors 1410c and conductors 1412c, and which "can be fabricated from glass or plastic, *among other materials*." *See id.* at 36:42–49 (emphasis added), Figs. 14D–14E.

This is not the situation in which a special definition for a claim term has been set forth in the specification with reasonable clarity, deliberateness, and precision, so as to give notice of the inventor's own lexicography. *See Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1370 (Fed. Cir. 2005); *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Nor do we discern that Patent Owner "demonstrate[d] an intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." *Teleflex, Inc. v. Ficosa North America Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002).

Here, based upon our review of the intrinsic evidence, no such special definition or express disavowal of the term "cover" to exclude epoxy and

resin exists. Patent Owner relies on the following description of Figure 14D in that regard:

> *In certain embodiments, the cylindrical housing 1430 (and transparent cover 1432)* forms an airtight or substantially airtight or hermetic seal with the submount 1400c. As a result, the cylindrical housing 1430 can protect the detectors 1410c and conductors 1412c from fluids and vapors that can cause corrosion. Advantageously, *in certain embodiments, the cylindrical housing 1430 can protect* the detectors 1410c and conductors 1412c *more effectively than currently-available resin epoxies*, which are sometimes applied to solder joints between conductors and detectors.

Ex. 1001, 36:50–59 (emphases added). First, the sentence cited by Patent Owner begins with the phrase "[i]n certain embodiments," which indicates the claimed invention is not limited and is open to other embodiments, so there is no lexicography or disavowal here. Second, we agree with Petitioner's reading of this passage as distinguishing the prior art from the claimed invention based on the *location* of the material (applied only to solder joints between conductors and detectors in the prior art, as opposed to covering the conductors and detectors in the invention) and not the *type* of material. Third, at best, the '191 patent expresses a preference for a cover to be made of glass or plastic, because such materials provide "more effective[]" protection than resin epoxies that were known when the '191 patent was filed. *See id.* at 36:55–59. But even this reading recognizes that resin epoxies provide some amount of protection, albeit perhaps a lesser amount than glass or plastic, and are not excluded from forming the material of a cover.

Dr. Kenny's deposition testimony cited by Patent Owner also does not persuade us that, in the context of the '191 patent, epoxy or resin is excluded from the material of a cover. Dr. Kenny testifies that "a layer of sealing

resin" "[c]ould" be used to protect the electronic components in a sensor (Ex. 2009, 395:22–396:8). He was then asked "So that would be one way to protect the components without using a cover, correct?" to which he answered "[t]here are many ways to protect the elements other than using a cover" and maintained that the proposed combination of prior art has a "cover" to achieve purposes *other than* protecting electronic components, i.e., "to improve adhesion and to improve light gathering for the operation of the system." *Id.* at 396:9–17. He did not squarely testify that sealing resin may never be a cover.

Accordingly, in the context of the '191 patent, we do not construe the claimed "cover" to exclude epoxy and resin.

2. Other Claim Terms

Upon consideration of the entirety of the arguments and evidence presented, we conclude no further explicit construction of any claim term is needed to resolve the issues presented by the arguments and evidence of record. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (per curiam) (claim terms need to be construed "only to the extent necessary to resolve the controversy" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said

subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-obviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of

[2] Patent Owner does not present objective evidence of non-obviousness.

related work experience with capture and processing of data or information." Pet. 4 (citing Ex. 1003 ¶¶ 21–22). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

Patent Owner makes several observations regarding Petitioner's identified level of skill in the art but, "[f]or this proceeding, [Patent Owner] nonetheless applies Petitioner's asserted level of skill." PO Resp. 10 (citing Ex. 2004 ¶¶ 35–38).

We adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa and Inokawa

Petitioner contends that claims 1–6, 8–16, 18, and 19 of the '191 patent would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 6–43.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled "Pulse Wave Sensor and Pulse Rate Detector," and discloses a pulse wave sensor that detects light output from a light emitting diode and reflected from a patient's artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

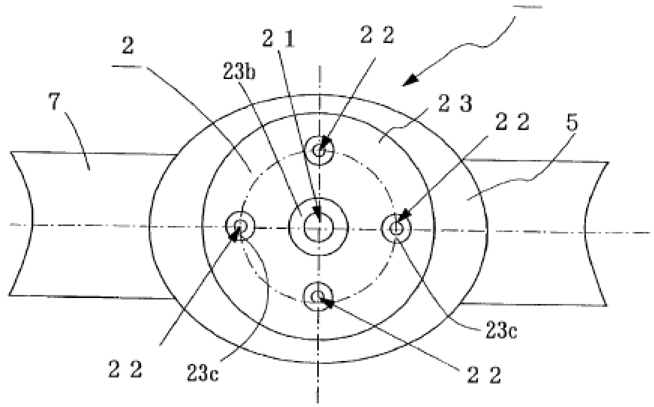


Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode ("LED") 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, "to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased." *Id.* ¶ 32, Fig. 4(a). "The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22." *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

FIG. 1 (b)

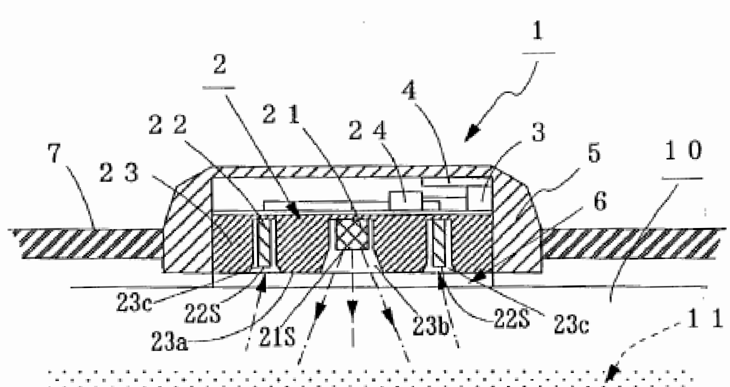


Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* ¶ 23. Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.* ¶ 23.

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* ¶ 24. Aizawa discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)." *Id.* ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. Overview of Inokawa (Ex. 1008)

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

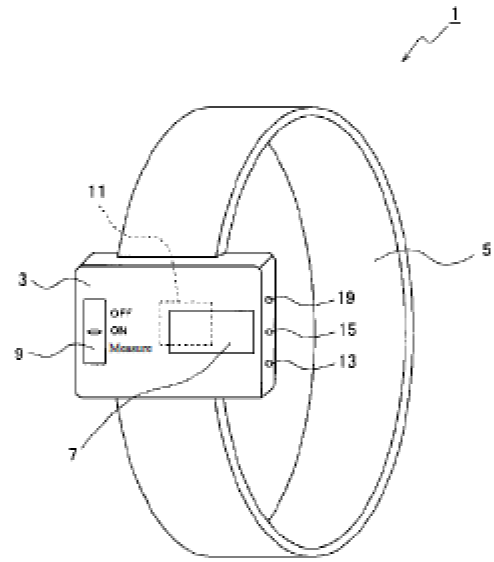


Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

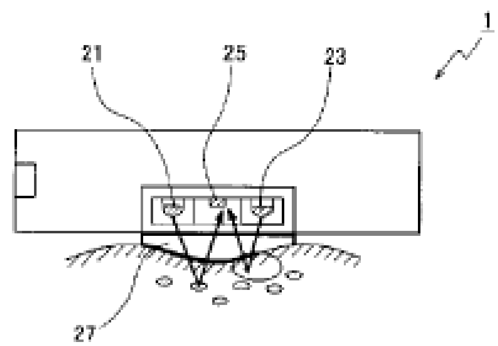


Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as

photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 senses "the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery)," and infrared LED 23 senses body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that "performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory." *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

(FIG. 3)

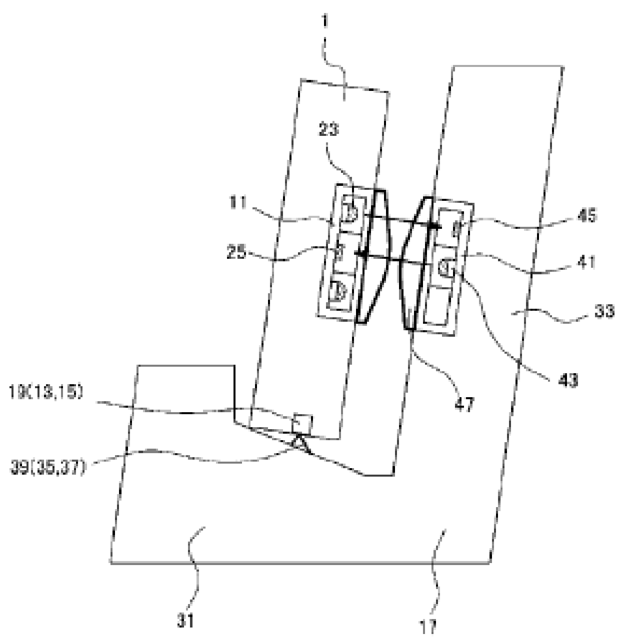


Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position,

pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Independent Claim 1

Petitioner contends that claim 1 would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 13–22 (combination), 22–29 (claim 1).

i. "A noninvasive optical physiological sensor comprising"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses a noninvasive optical physiological measurement device, i.e., a pulse sensor. Pet. 22–23; *see, e.g.*, Ex. 1006 ¶ 2 ("[A] pulse wave sensor for detecting the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist with light.").

ii. "[a] a plurality of emitters configured to emit light into tissue of a user"

<u>Petitioner's Undisputed Contentions</u>

Petitioner contends that Aizawa discloses one emitter—LED 21—and also states that, in certain embodiments, multiple LEDs may be employed. Pet. 7, 17. Patent Owner does not dispute this contention, and we agree with Petitioner. *See* Ex. 1006 ¶¶ 23 ("LED 21"), 32 ("The arrangement of the

light emitting diode 21 and the photodetectors 22 is not limited to this."). For example, Aizawa explains that "[t]he same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector." *Id.* ¶ 33.

Petitioner also contends that Inokawa teaches a sensor with two LEDs, a green LED to sense pulse and an infrared LED to sense body motion. Pet. 10–11. Petitioner contends that when Inokawa's sensor is mounted on a base device, the infrared LED is used to wirelessly transmit vital information to the base device. *Id.* at 12–13. Patent Owner does not dispute these contentions, and we agree with Petitioner. Inokawa teaches a pair of LEDs 21, 23, where "the basic function of the S-side green LED 21 is to sense the pulse from the light reflected off of the body . . ., while the S-side infrared LED 23 serves to sense body motion from the change in this reflected light." Ex. 1008 ¶¶ 58–59. Inokawa also explains that "vital sign information stored in the memory 63 [of the sensor], such as pulse and body motion, is transmitted to the base device 17 using the S-side infrared LED 23 of the pulse sensor 1 and the B-side PD 45 of the base device 17," such that "there is no need to use a special wireless communication circuit or a communication cable." *Id.* ¶¶ 76–77.

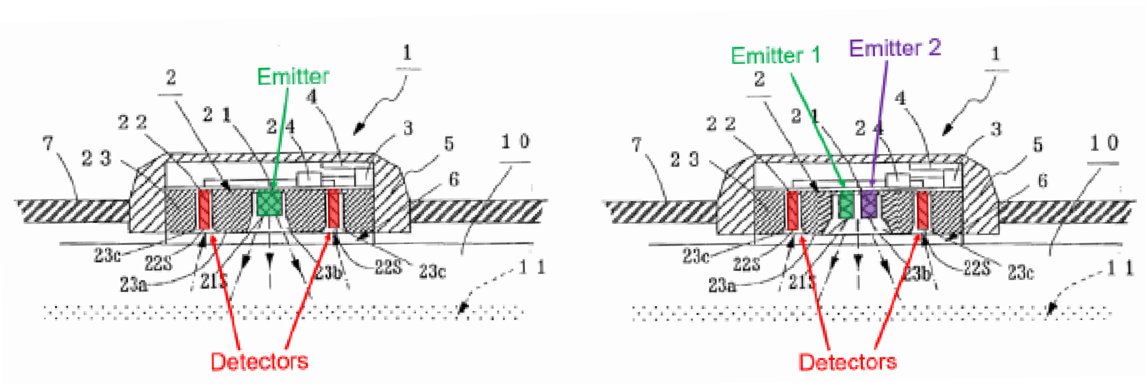
<u>Petitioner's Disputed Contentions</u>

Moreover, Petitioner contends that a person of ordinary skill in the art would have been motivated to "provid[e] an additional emitter to Aizawa [to] allow Aizawa's device to use its existing infrared LED to detect body motion while using the added green LED to detect pulse," which would have provided "more reliable pulse measurement that takes into account and

corrects for inaccurate readings stemming from body movement." Pet. 17–18, 24; Ex. 1003 ¶¶ 71–73.

As a second and independent motivation, Petitioner also contends that incorporating Inokawa's teachings would have allowed for wireless data communication from Aizawa's sensor, without the need for a physical communications cable or a separate wireless communication circuit. Pet. 20–21. Petitioner contends that although Aizawa discloses data transmission, Aizawa "is silent about how such transmission would be implemented." *Id.* at 19–20. According to Petitioner, a skilled artisan "would have . . . recognized that incorporating Inokawa's base device and LED-based data transmission would allow Aizawa to upload data from its sensor in a way that is wireless (thus avoiding the problems of a physical cable) and that does not require a separate RF circuit," and which would "improve data transmission accuracy by using the second LED, such as the green LED, to transmit checksum information." *Id.* at 21–22 (citing, e.g., Ex. 1003 ¶¶ 77–79).

To illustrate its proposed modification, Petitioner includes annotated and modified views of Aizawa's Figure 1(b), reproduced below. Pet. 18; *see also id.* at 23 (same); Ex. 1003 ¶ 72.



Petitioner's modified figure on the left depicts the sensor of Aizawa, with its single emitter identified and colored green; Petitioner's modified figure on the right depicts Aizawa's sensor in which the single emitter has been divided into two emitters, colored green and purple, operating at two different wavelengths, as Petitioner contends would have been rendered obvious by Inokawa. Pet. 18–19, 23–24. Petitioner contends that this modification entails use of a known solution to improve similar systems in the same way and would have achieved predictable results. *Id.* at 19, 22 (citing Ex. 1003 ¶¶ 73–74, 80); *see also id.* at 23–24 (citing, e.g., Ex. 1003 ¶¶ 69–81).

<u>Patent Owner's Arguments</u>

Patent Owner disputes Petitioner's contentions regarding the obviousness of modifying Aizawa to include two emitters. *See* PO Resp. 36–42; Sur-reply 13–15.

First, Patent Owner argues that neither Aizawa nor Inokawa discloses a device with multiple detectors *and* multiple emitters in the *same* sensor, because Aizawa's embodiments have either a single emitter and multiple detectors (e.g., Ex. 1006, Fig. 1(a)) or multiple emitters and a single detector (e.g., *id.* ¶ 33), and Inokawa discloses multiple emitters and a single detector (e.g., Ex. 1008, Fig. 2). *See* PO Resp. 36–37 (citing, e.g., Ex. 2004 ¶¶ 79–80).

Second, Patent Owner argues that the evidence does not support either of Petitioner's two proffered motivations for modifying Aizawa to include two emitters. As to the first motivation (to measure body movement using a second emitter), Patent Owner asserts that Dr. Kenny erroneously testifies that Aizawa cannot do this with its single emitter. PO Resp. 38 (citing, e.g.,

Ex. 1006 ¶ 15; Ex. 2007, 400:7–401:10; Ex. 2004 ¶ 84). Patent Owner argues that "Aizawa, however, expressly states that it provides a 'device for ***computing*** the ***amount*** of motion load from the pulse rate.'" *Id.*

As to Petitioner's second motivation (to enable data transmission to a base device using an optical communication link), Patent Owner argues that "Aizawa ***already*** includes a wireless transmitter . . . so Aizawa does not need to incorporate Inokawa's base-device [optical] data transmission arrangement." PO Resp. 38–39 (citing, e.g., Ex. 1006 ¶¶ 23, 28, 35; Ex. 2004 ¶¶ 85–86). Indeed, Patent Owner argues "Dr. Kenny acknowledged Aizawa does not indicate there are any problems with Aizawa's form of data transmission." *Id.* at 39 (citing Ex. 2007, 409:13–410:2). Patent Owner further argues that "Aizawa's goal is 'real-time measuring' with the transmitter 'transmitting the measured pulse rate data to a display'" but that "Inokawa's base device, however, only transmits pulse rate data 'when the pulse sensor . . . is mounted onto the base device'" and, thus, "***eliminates*** the ability to take and display ***real-time*** measurements." *Id.* at 39–40 (citing, e.g., Ex. 1006 ¶¶ 4, 15; Ex. 1008, Abstract; Ex. 2004 ¶ 86).

Patent Owner insists Inokawa does not aid Petitioner's case because Inokawa discloses the benefits of using a second emitter in only two situations: (1) to improve over a "mechanically-connected system," e.g., with a cable for communication, and, (2) to avoid use of a "dedicated wireless communication circuit," whereas "Aizawa ***already*** uses wireless transmission to provide real-time heart measurements." *Id.* at 40–41 (citing, e.g., Ex. 1008 ¶ 4; Ex. 2004 ¶ 87).

Third, Patent Owner accuses Petitioner and Dr. Kenny of overlooking further complications that would ensue from modifying Aizawa to have two emitters. Patent Owner argues that Dr. Kenny overlooked how placing "two LEDs in close proximity may cause thermal interference that could create significant issues for sensor performance." PO Resp. 41 (citing, e.g., Ex. 2004 ¶ 88). Patent Owner also argues that in the proposed modification, when Dr. Kenny added a second LED, "he widened [Aizawa's] cavity without . . . disclosing in his declaration that he had done so," which could impact optical performance of the device. *Id.* at 41–42.

Petitioner's Reply

Concerning Petitioner's first motivation, Petitioner asserts that Aizawa does not disclose any details related to data transmission, and adding an additional LED enables the sensor to distinguish between blood flow and body movement, which provides a "more reliable" pulse measurement, which is Petitioner's asserted improvement to Aizawa. Pet. Reply 16 (citing, e.g., Ex. 1003 ¶ 72; Ex. 2007, 401:11–402:4; Ex. 1047 ¶ 36). Moreover, Petitioner contends that by using multiple LEDs at different wavelengths, "two separate signals" can be collected, which "will allow Aizawa's system to 'take into account and correct for inaccurate readings related to body movement' by subtracting the 'signal component corresponding to body movement [] from the pulse signal to help better isolate the desired pulse data.'" *Id.* (quoting Ex. 1003 ¶ 72).

Concerning Petitioner's second motivation, Petitioner maintains that Inokawa's use of two emitters having different wavelengths to upload data to a base device using optical communication advantageously improves the accuracy of the transmission by providing checksum information. *Id.* at 17

(citing, e.g., Ex. 1003 ¶ 78; Ex. 1008 ¶¶ 111, 44, 48; Ex. 2007, 407:7–408:20, 416:5–15; Ex. 1047 ¶ 38). Moreover, Petitioner notes that Aizawa mentions real-time measurement only once and does not "mention that such data must also be transmitted to some external device in real time." *Id.* at 18 (citing Ex. 1047 ¶ 38). Likewise, Petitioner explains that a person of ordinary skill in the art "would have been fully capable of weighing potential benefits associated with different transmission methods, for instance recognizing that a quicker transmission may be achieved in one instance and a more accurate one in another." *Id.*

As to the "other complications" that Patent Owner alleges would result from the proposed modification, Petitioner asserts "such minor issues are 'part of what [a person of ordinary skill in the art] would bring . . . to the problem and would know how to make the changes needed.'" *Id.* at 18 (quoting Ex. 2007, 384:8–388:12; Ex. 1047 ¶ 39).

<u>Patent Owner's Sur-reply</u>

Concerning Petitioner's first motivation, Patent Owner argues that Inokawa's disclosure is just as sparse as Aizawa's disclosure regarding how to use optical data to measure body movement. PO Sur-reply 13–14 (citing Ex. 1008 ¶ 59). Patent Owner also asserts that "Petitioner cites nothing in Inokawa that suggests" that Inokawa's two emitter data gathering is more reliable or otherwise superior to Aizawa's single emitter data gathering. *Id.*

Concerning Petitioner's second motivation, Patent Owner argues that the proposed modification eliminates Aizawa's ability to conduct "***real-time*** collection and display of physiological measurements—a key goal of Aizawa's system." *Id.* at 14.

Patent Owner also notes that Petitioner does not dispute that the proposed modification would cause problems such as "additional costs, energy use, and thermal problems" that would ensue from using two emitters in Aizawa's device. *Id.* at 15.

<u>Analysis</u>

Upon review of the foregoing, we conclude that a preponderance of the evidence supports Petitioner's contention that it would have been obvious to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, in light of Inokawa.

First, a person of ordinary skill in the art would have been motivated to make this replacement to improve the pulse measurements recorded by Aizawa's detector. Inokawa teaches that the infrared LED's signal can be used "to detect vital signs" such as "body motion," and the green LED's signal can be "used to detect pulse." Ex. 1008, Fig. 2, ¶¶ 7, 14, 58–59.

Patent Owner correctly points out that Aizawa describes its single-emitter detector as transmitting its pulse data to "a device for computing the amount of motion load from the pulse rate." Ex. 1006 ¶¶ 15, 28, 35. But, this description is the only cited disclosure in Aizawa concerning computing a motion characteristic of the user. Further, we are unable to discern any other disclosure in Aizawa relating to motion computation, or what Aizawa proposes to do with its motion computation. *See id.* Based on the sparse nature of Aizawa's disclosure concerning motion load, it is not clear exactly what Aizawa proposes to do with the computed motion load, after it is computed. *See, e.g.*, Ex. 1047 ¶ 36 ("Patent Owner fails to explain how Aizawa senses and computes motion load. Indeed, Aizawa is completely silent on this point."). Aizawa does,

however, describe the motion load as being computed "from the pulse rate," rather than being an input to the pulse rate calculation. Ex. 1006 ¶¶ 15, 35.

In a deposition for other proceedings related to this *inter partes* review, *see supra* § I.B, Dr. Kenny whether "Aizawa's sensor could not account for motion load?"; Dr. Kenny answered that "Aizawa's sensor attempts to prevent motion load rather than account for it." Ex. 2007, 400:7–11 (deposition for IPR2020-01520, IPR2020-01537, and IPR2020-01539). He explained that, because Aizawa uses only a single emitter with a single wavelength, "what [Aizawa] sees as a signal would be some mixture of pulse rate and motion load if there was no effort to prevent motion load," so Aizawa seeks to solve the problem of "prevent[ing] motion load from corrupting the pulse rate signal." *Id.* at 400:12–401:10. Dr. Kenny did not further explain this distinction between preventing and accounting for motion load in his deposition testimony cited by the parties as relating to this issue. *Id.* at 400:7–402:4. We do not rely on this distinction as a basis for our present decision, because we find no express support for it in Aizawa's disclosure (*see* Ex. 1006 ¶¶ 15, 28, 35), and it is not explained in persuasive detail by Dr. Kenny.

We nonetheless credit Dr. Kenny's declaration testimony that a person of ordinary skill in the art, upon reviewing Inokawa's disclosure of using two emitters of different wavelengths to calculate a user's pulse and motion separately, would have understood that these two separate measurements would "allow for a more reliable pulse measurement that takes into account *and corrects for* inaccurate readings stemming from body movement" by "subtracting the 'signal component corresponding to body movement [] from the pulse signal to help better isolate the desired pulse data.'" Ex. 1047

¶¶ 35, 36, 37 ("processed in a way to compensate for movement and create a more reliable measurement of the physiological parameter"); Ex. 1003 ¶¶ 71–73. Aizawa does not disclose using the computed motion load in this fashion, so it appears that this would improve upon the accuracy of Aizawa's pulse measurements, by using the computed motion load to isolate and account for noise. *See* Ex. 1006 ¶¶ 15, 28, 35.

Dr. Madisetti offers no meaningful opposing testimony in this regard. *See, e.g.*, Ex. 2004 ¶ 84. Instead, Dr. Madisetti incorrectly reads Dr. Kenny's motivation testimony as being limited to the desirability of adding the bare ability to measure body movement to Aizawa. *See id.* In fact, Dr. Kenny further testified that it would have been beneficial to *use* the measured body movement to *improve* the pulse measurement of the device. *See* Ex. 1003 ¶¶ 71–73; Ex. 1047 ¶¶ 36–37. Dr. Madisetti does not address that testimony. *See* Ex. 2004 ¶ 84.

Thus, because Dr. Madisetti's testimony sets up a straw man to attack, rather than directly addressing the entirety of Dr. Kenny's testimony in this regard, Dr. Kenny's testimony stands unrebutted in the record before us. Dr. Kenny's testimony also makes intuitive sense that measuring the user's motion *separately* from the user's pulse measurement, for example by using two interrogating emitters of two different wavelengths, would provide a reliable means of correcting the pulse data for motion artifacts by using the separately measured motion data, rather than by trying to segregate these two components in the single data stream provided by Aizawa's single emitter device. *See, e.g.*, Ex. 1047 ¶¶ 36–37. We, therefore, are persuaded by Dr. Kenny's unrebutted testimony that using two emitters of different wavelengths would improve Aizawa's device in this way.

Independently, we are also persuaded that a person of ordinary skill in the art would have been motivated to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, to provide a reliable method of uploading pulse data stored by Aizawa's wrist-worn pulse rate detector 1 to another device for display to the user. Inokawa expressly touts such optically-based uploading of data from Inokawa's wrist-worn sensor 1 to Inokawa's base device 17 as a benefit of incorporating two emitters in sensor 1. *See* Ex. 1008, Figs. 3, 19, ¶¶ 3–7, 14, 76–77, 109–111. Inokawa identifies two specific benefits of this optically-based data communication means. First, the infrared LED can transmit the pulse data, and the green LED can separately transmit "checksum" information to increase the accuracy of data transmission. *Id.* at Fig. 19, ¶¶ 14, 109–111. Second, using light emitters in this fashion to perform two functions (data collection by emitting light into the user's wrist, and data transmission by emitting light to photodetectors in a base device) obviates the need for providing "a special wireless communication circuit [in the wrist-worn sensor 1] or a communication cable." *Id.* ¶¶ 3–7, 76–77.

Patent Owner correctly points out that Aizawa already has a "transmitter" 4 for uploading pulse data stored by Aizawa's wrist-worn pulse rate detector 1 to another device for processing and for display to the user. Ex. 1006, Fig. 1(b), ¶¶ 15, 23, 28, 35. However, Aizawa's Figure 1(b) illustrates transmitter 4 only as an empty box contained within outer casing 5, and Aizawa's written description does not provide further structural details concerning transmitter 4. *See id.* In particular, Aizawa does not describe exactly how transmitter 4 transmits its data to the other device. *See id.*

Patent Owner contends that Aizawa's transmitter 4 is a "wireless" transmitter, and Dr. Kenny agreed to as much during his deposition. *See, e.g.*, PO Resp. 40; Ex. 2007, 414:19–21. They appear to equate "wireless" communication to radio frequency communication, and not to include optical communication, even though both radio frequency and optical communication do not use a wire. Based on the foregoing testimony, we assume, for this decision, that Aizawa contemplates radio frequency communication as one embodiment by which transmitter 4 may transmit data to devices other than detector 1.

Patent Owner argues, and Dr. Madisetti testifies, that Aizawa's express disclosure goes even further. They assert Aizawa's "goal" is to measure and display pulse data *in real time during exercise*, using the wireless transmitter. *See, e.g.*, PO Resp. 39; Ex. 2004 ¶¶ 86 ("the ability to take and display real-time measurements, one of Aizawa's stated goals"), 87. We find that Aizawa does not support this assertion. Instead, Aizawa discusses prior art devices that "estimat[e] a burden on the heart of a person who takes exercise by *real-time measuring* his/her heart rate at the time of exercise" (Ex. 1006 ¶ 4 (emphasis added)), and then describes Aizawa's detector 1 as having a transmitter for transmitting the measured pulse rate data to another device for display (*id.* ¶ 15). Aizawa does not indicate when this transmission occurs. Aizawa also refers to "noise caused by the shaking of the body of the subject" as a problem to be addressed (*id.* ¶ 6), but this problem occurs regardless of whether the shaking results from exercise or the normal movement of the user's wrist over the course of the day. Thus, Aizawa does not tout, as an important feature of Aizawa's invention, the *real time display* of pulse rate data during exercise, regardless of whether the

data gathered by Aizawa's wrist-worn detector 1 is transmitted wirelessly or otherwise. *Id.* ¶¶ 4, 6, 15.

No doubt, a person of ordinary skill in the art would have viewed the capability of a wrist-worn pulse detector to transmit its pulse data to another device for display in real time while the user is exercising to be a desirable feature in some cases, even if this is not one of Aizawa's specifically stated goals. *See, e.g.*, Ex. 1048 ¶ 67 (Dr. Kenny stating: "By wirelessly transmitting the collected data . . . the condition of a subject [can be determined] 'remotely.'"); Ex. 2009, 393:6–14 (in a deposition for other related proceedings, Dr. Kenny agreeing that a person of ordinary skill in the art "would have seen the ability to wirelessly transmit collected data as an advantage"). Nonetheless, Inokawa expressly discloses that, in other cases, the benefits achieved by wireless transmission can be outweighed by obviating the need for the wrist-worn sensor to include a special wireless communication circuit. *See* Ex. 1008 ¶¶ 3–7 (discussing problems associated with wireless transmission, such as the need for a dedicated circuit, which is avoided by Inokawa's system with "few malfunctions" and a "simple structure"), 76–77 ("As a result, there is no need to use a special wireless communication circuit . . ., which makes it possible to transmit vital sign information to the base device 17 accurately, easily, and without malfunction."). We therefore conclude that Petitioner's case for obviousness in this regard is supported by a preponderance of the evidence. *See, e.g.*, *In re Urbanski*, 809 F.3d 1237, 1243–44 (Fed. Cir. 2016) (persons of ordinary skill in the art may be motivated to pursue desirable properties of one prior art reference, even at the expense of foregoing a benefit taught by another prior art reference).

We disagree with Patent Owner's argument that Petitioner's case for obviousness is deficient on the basis that neither Aizawa nor Inokawa expressly discloses a wrist-worn sensor device that has *both* a plurality of emitters *and* at least four detectors, as claim 1 recites. Obviousness does not require "'some motivation or suggestion to combine the prior art teachings' [to] be found in the prior art." *KSR*, 550 U.S. at 407, 415–418. Nor does it require the bodily incorporation of Inokawa's device into Aizawa's device. *See, e.g.*, *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (test for obviousness is not whether the features of one reference may be bodily incorporated into the structure of the other reference, but rather is "what the combined teachings of the references would have suggested to those of ordinary skill in the art"); *see also In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (nonobviousness is not established by attacking references individually when unpatentability is predicated upon a combination of prior art disclosures). Instead, "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton," and "in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *KSR*, 550 U.S. at 420–421.

In this case, we are persuaded that a person of ordinary skill in the art would have been motivated to modify Aizawa's wrist-worn detector 1 to replace its single near infrared LED 21 with an infrared LED and a green LED, based on Inokawa, for all the reasons provided above. A person of ordinary skill in the art would additionally have known to keep all four detectors 22 that are already present in Aizawa's detector 1, so that "[e]ven when the attachment position of the sensor is dislocated, a pulse wave can be detected accurately," as disclosed by Aizawa. Ex. 1006 ¶¶ 9, 27. In short,

the combination of Aizawa and Inokawa teaches that having multiple emitters is beneficial, and having multiple detectors is beneficial, for different and not inconsistent reasons.

Finally, we agree with Petitioner's position that any thermal interference and power consumption issues that may arise in Aizawa's wrist-worn pulse detector, by using two emitters instead of one emitter, are well within the capabilities of a person of ordinary skill in the art to solve. We credit Dr. Kenny's testimony in this regard. *See* Ex. 1003 ¶¶ 74, 80 ("would have led to the predictable result of more accurate and convenient data transmission without significantly altering or hindering the functions performed by Aizawa's sensor"); Ex. 1047 ¶ 39. For example, Dr. Kenny acknowledges that Aizawa already discloses adding additional emitters. Ex. 1003 ¶ 39 (citing Ex. 1006 ¶ 33). Dr. Kenny further testifies that this modification "amount[s] to nothing more than the use of a known technique [i.e., Inokawa's use of two emitters in a wrist-worn pulse detector] to improve similar devices [i.e., Aizawa's wrist-worn pulse detector] in the same way and combining prior art elements according to known methods to yield predictable results." *Id.* ¶¶ 74, 80.

Patent Owner cites portions of Dr. Kenny's deposition testimony that, in Patent Owner's view, indicate Dr. Kenny fails to appreciate the significance of optical interference complications posed by adding a second emitter to Aizawa's device, and fails to explain how this would have been overcome. *See* PO Resp. 56–57 (citing Ex. 2007, 379:17–21, 384:16–388:16, 389:17–390:20, 394:11–395:17). We have reviewed this deposition testimony, and we conclude Patent Owner overstates its significance. It establishes, at most, that Dr. Kenny did not expressly address this issue in

his declaration (Exhibit 1003), but Dr. Kenny's opinion is that this would have been within the capability of a person of ordinary skill in the art to resolve. Based on the evidentiary record presented to us, we agree with Dr. Kenny. For example, Inokawa discloses a wrist-worn pulse sensor 1 having two emitters 21 and 23 in close proximity to each other. *See* Ex. 1008, Figs. 1–2. An artisan must be presumed to know something about the art apart from what the relied-upon references disclose. *See In re Jacoby*, 309 F.2d 513, 516 (CCPA 1962).

Dr. Madisetti's testimony opposing Dr. Kenny's foregoing opinion is premised solely on Dr. Kenny's alleged failure to explain how issues that arise from adding a second emitter to Aizawa would have been solved; Dr. Madisetti does not provide any affirmative reason why these issues would have been difficult for a person of ordinary skill in the art to solve, in the context of Aizawa's device or wrist-worn pulse sensing devices in general. *See* Ex. 2004 ¶ 88.

Thus, we conclude a person of ordinary skill in the art would have been motivated to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, and would have had a reasonable expectation of success in doing so.

iii. "[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses at least four detectors 22 that detect light that has been emitted by LED 21 and attenuated by body tissue. Pet. 24–25; *see, e.g.*, Ex. 1006 ¶ 27 (disclosing that light emitted from LED 21 "is reflected by a

red corpuscle running through the artery 11 of the wrist 10 and . . . is detected by the plurality of photodetectors 22 so as to detect a pulse wave"); Ex. 1003 ¶¶ 82–83.

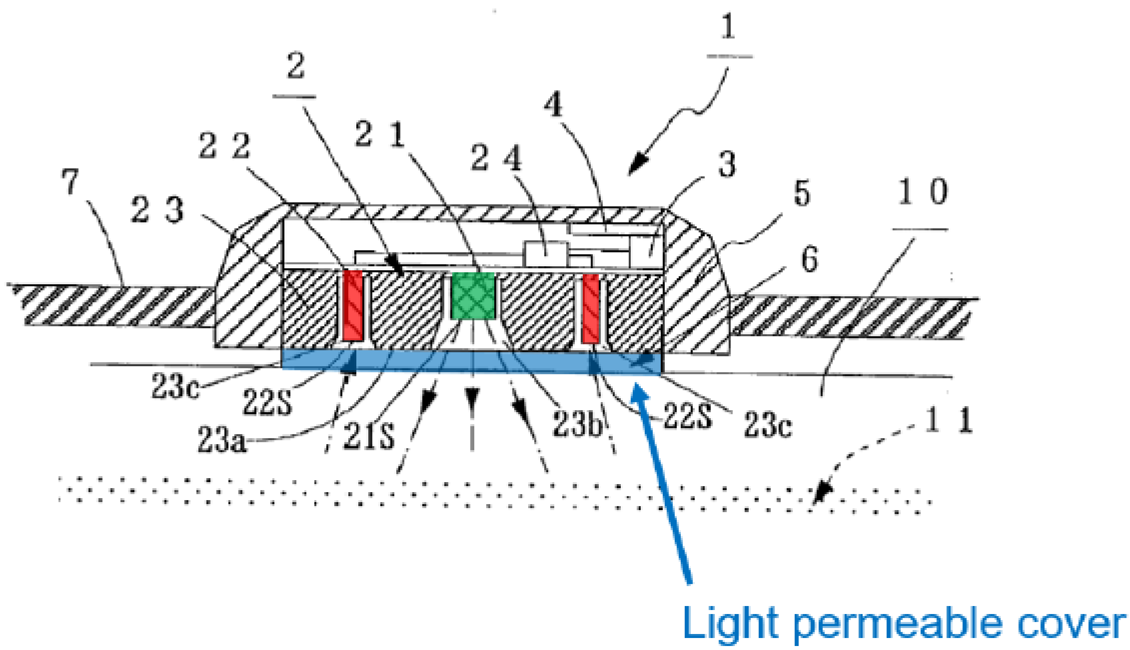
iv. "[c] a housing configured to house at least the plurality of detectors in a circular portion of the housing"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23, which houses the detectors in a circular portion of the housing. Pet. 25; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing . . . light emitting diode 21 and the photodetectors 22"), Figs. 1(a)–(b) (depicting circular holder 23 surrounding detectors 22).

v. "[d] a lens configured to be located between tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor is worn by the user and during operation of the noninvasive optical physiological sensor"

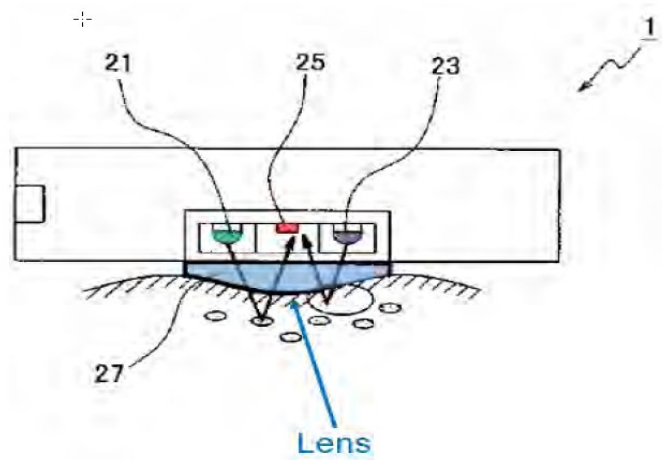
<u>Petitioner's Contentions</u>

With reference to an annotated version of Aizawa's Figure 1(b) (reproduced below), Petitioner contends that Aizawa "teaches a light permeable cover in the form of an acrylic transparent plate 6 (blue) that is mounted at the detection face 23a" of the sensor, between the user's tissue and the emitter/detector assembly. Pet. 8–9; Ex. 1003 ¶¶ 55–56.



The figure above shows Petitioner's annotated version of Aizawa's Figure 1(b), in which transparent plate 6 is shaded in blue and identified as "Light permeable cover." Petitioner contends that beyond disclosing that the acrylic transparent "helps improve 'detection efficiency,' Aizawa does not provide much other detail, for instance regarding its shape." Pet. 13 (citing Ex. 1006 ¶ 30).

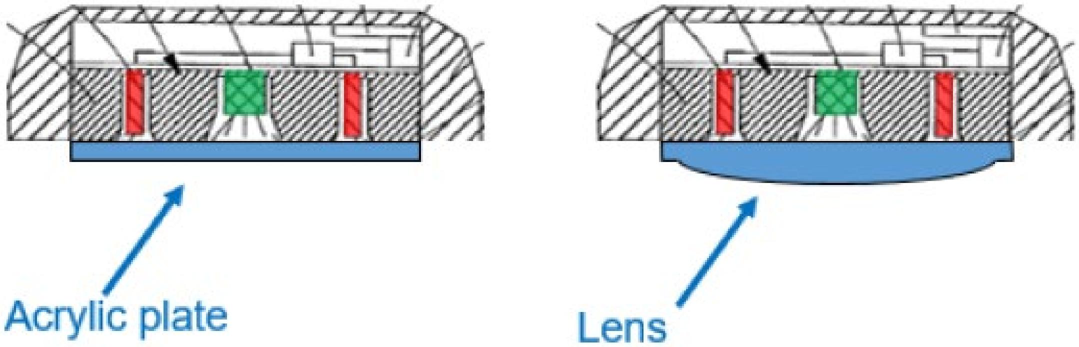
Petitioner reasons, however, that one of ordinary skill in the art would have "looked to Inokawa to enhance light collection efficiency, specifically by modifying the flat cover of Aizawa to include a convex protrusion that acts as a lens." *Id.* at 14 (citing Ex. 1003 ¶¶ 87–91), 27 ("obvious to modify the flat acrylic plate of Aizawa . . . into a lens having a single outwardly protruding convex surface . . . to further Aizawa's objective of enhancing its light-collection efficiency"). In that regard, Petitioner points to Inokawa's Figure 2. Petitioner's annotated version of that figure is reproduced below.



Id. at 14. Figure 2 above depicts Inokawa's lens 27 shaded in blue.

Petitioner expresses that "Inokawa teaches that its cover may be either flat . . . such that 'the surface is less prone to scratches'" or may be in the form of the lens shape shown above to "increase the light-gathering ability of the LED." *Id.* at 15–16 (quoting Ex. 1008 ¶ 15); *see* Ex. 1003 ¶¶ 88–91. Petitioner contends that a person of ordinary skill in the art "making the design choice to prioritize improved improved light collection efficiency over reduced suseptibility to scratches could have readily modified Aizawa's cover to include a lens as per Inokawa." Pet. 16 (citing Ex. 1003 ¶ 91). Petitioner also contends that a skilled artisan would have had a reasonable expectation of success in combining those teachings. *Id.* at 15 (citing Ex. 1003 ¶ 90). Petitioner adds that Aizawa's "transparent acrylic material . . . can be readily formed into a lens as in Inokawa." *Id.* at 16 (citing Ex. 1003 ¶ 91; Ex. 1009, 3:46–51, Fig. 1; Ex. 1023, Fig. 6, ¶¶ 22, 32, 35).

Petitioner provides annotated and modified versions of Aizawa's Figure 1(b) that depict the modification of the proposed combination, which are reproduced below. *Id.* at 15 (citing Ex. 1003 ¶ 89).



Petitioner's annotated figure on the left depicts the device with Aizawa's flat cover, and the annotated and modified figure on the right depicts the device resulting from the combination of Aizawa and Inokawa, in which a person of ordinary skill in the art would have replaced Aizawa's flat cover with a curved protrusion to "increase the light-gathering ability." *Id.* (quoting Ex. 1008 ¶ 15).

According to Petitioner, a person of ordinary skill in the art "would have understood how to implement Inokawa's lens in Aizawa's device with a reasonable expectation of success." Pet. 15 (citing Ex. 1003 ¶ 90). The shape of the modified cover in Dr. Kenny's illustration of the proposed modification above is similar to the shape of an LED lens illustrated in Exhibit 1023 (hereafter "Nishikawa"),[3] referenced by Petitioner and Dr. Kenny in connection with the proposed ground of unpatentability. *Compare* Pet. 15 (illustrating proposed modification), *with* Ex. 1023, Fig. 6, ¶¶ 3, 22, 30, 32, 35 (illustrating lens 50 used with LED 22, and discussing how to make the illustrated device); *see also* Pet. 16 (citing Ex. 1023), 50 (discussing teachings of Ex. 1023).

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[3] U.S. Patent Application Publication No. 2007/0145255 A1, filed Dec. 20, 2006, published June 28, 2007 (Ex. 1023).

Petitioner also contends that, in the proposed modification, the convex surface of the lens will cause the user's tissue to conform because the rigid cover will be pressed against the user's skin with pressure. Pet. 28–29; Ex. 1003 ¶¶ 92–93, 98; Ex. 1006 ¶¶ 6, 23, 26, 30, 34; Ex. 1008, Fig. 2.

Patent Owner's Arguments

Patent Owner contends that the evidence does not support Petitioner's argument that it would have been obvious to modify Aizawa's cover to have a lens with an outwardly protruding convex surface, in order to improve detection efficiency by directing incoming light to Aizawa's photodetectors 22, with a reasonable expectation of success. PO Resp. 15–36; PO Sur-reply 1–13; Ex. 2004 ¶¶ 48–78.

According to Patent Owner, the evidence establishes that Petitioner's proposed modification would direct light *toward the center* of Aizawa's detector 1 where emitter 21 is located, rather than *toward the periphery* where detectors 22 are located. PO Resp. 15–23; Ex. 2004 ¶¶ 48–65. Thus, Patent Owner's view is that a person of ordinary skill in the art "would ***not*** have expected Inokawa's protruding surface to accomplish" the objective of enhancing light collection efficiency relied upon by Petitioner, because Petitioner's proposed modification instead "would direct light ***away*** from the ***periphery***-located detectors" in Aizawa, the opposite result to Petitioner's contention. PO Resp. 19; Ex. 2004 ¶¶ 42–43, 48–57.

In support, Patent Owner points to Inokawa's Figure 2, in which two arrows illustrate light that passes through the convex protrusion of lens 27 toward the center of Inokawa's pulse sensor 1 where detector 25 is located. PO Resp. 16–17 (citing Ex. 1008 ¶ 58); Ex. 2004 ¶¶ 51–52. Patent Owner also points to the '191 patent's Figure 14B, which illustrates several light

rays 1420, 1422 passing through a partially cylindrical protrusion 605 to be centrally focused on detector(s) 1410B. PO Resp. 18 (citing Ex. 1001, 36:3–6, 36:13–15; Ex. 2004 ¶¶ 53–54). Patent Owner cites portions of Dr. Kenny's deposition testimony that, in Patent Owner's view, support Patent Owner's contentions in these regards. *See* PO Resp. 2, 16–17 (citing Ex. 2006, 83:15–84:2, 86:19–87:1, 108:21–109:14, 202:11–204:20, 204:1–20).

Patent Owner also asserts that "Dr. Kenny admitted that the impact of Inokawa's convex lens would not be 'obvious' in the context of [the] different configuration of LEDs and detectors" presented by Aizawa. PO Resp. 19–20 (citing Ex. 2006, 87:2–6). For example, Patent Owner points out that "light reaching Aizawa's detectors must travel in an opposite direction from the light in Inokawa." *Id.* at 20 (Ex. 2004 ¶¶ 59–62). In addition, according to Patent Owner, "Petitioner's combination is particularly problematic because" Aizawa uses "small detectors [22] with small openings [of cavities 23c] surrounded by a ***large*** amount of ***opaque*** material." PO Resp. 21 (citing Ex. 1006, Fig. 1(a); Ex. 2004 ¶ 63). In support of its view, Patent Owner cites portions of Dr. Kenny's deposition testimony. *Id.* at 22 (citing Ex. 2006, 257:11–18). Patent Owner also argues that to account for this, "Petitioner is forced to increase the size of Aizawa's detectors approximately five-fold and eliminate Aizawa's large opaque barriers—with no analysis or explanation of such changes or the[ir] impact." *Id.* at 22–23 (citing Ex. 2004 ¶ 65).

Patent Owner further argues that Dr. Kenny, during his deposition, attempted to evade the foregoing problems by "disclaim[ing] Petitioner's reasoning [for obviousness] and assert[ing] new and improper opinions" that

undermine the reasoning provided in the Petition. PO Resp. 23. For example, Patent Owner asserts that Dr. Kenny's attempt to distinguish between the '191 patent's Figure 14B as illustrating a lens that condenses *collimated* light toward the center, as compared to Aizawa and Inokawa in which the lens focuses *diffuse* light reflected by the user's body is not persuasive and is not supported by record evidence. PO Resp. 24–25 (citing Ex. 2006, 170:9–171:5; Ex. 2007, 288:13–289:5, 294:17–298:10, 298:11–299:18, 423:7–424:18; Ex. 2004 ¶¶ 67–68). Patent Owner also objects to Dr. Kenny's testimony that, "while a protruding surface would generally direct more light to the center," it "would also capture some light that otherwise would not be captured" by Aizawa's detectors 22, as lacking evidentiary support and relying on impermissible hindsight. PO Resp. 26 (citing Ex. 1001, 7:61–63; Ex. 2004 ¶¶ 69–70; Ex. 2006, 204:21–206:5, 206:22–208:1; Ex. 2007, 294:17–298:10).

Patent Owner moreover asserts that "Dr. Kenny repeatedly distanced himself from his own similar combination" of Aizawa and Inokawa by refusing to talk about the specific shape, size, material, and dimensional tolerances of the combination, so, in Patent Owner's view, his testimony falls short because it demonstrates at most only that the references could have been combined. *Id.* at 2–3, 27–31 (citing, e.g., Ex. 2004 ¶¶ 71–73; Ex. 2006, 51:14–52:16, 75:20–77:2, 91:9–92:13, 96:20–21, 97:11–21, 100:17–101:18, 132:10–18, 154:4–7, 164:8–16, 189:11–190:3; Ex. 2007, 308:12–309:8, 310:18–311:9, 318:3–6, 324:21–325:19, 333:20–335:4).

Indeed, according to Patent Owner, because ordinary skill does not require specific education or experience with optics or optical physiological monitors (*see supra* Section II.C), "[i]t strains credibility that a [person of

ordinary skill in the art] . . . could balance all of the factors Dr. Kenny identified" to reach the claimed invention. PO Resp. 31. Patent Owner relies on Dr. Kenny's testimony as establishing the complexity of designing optical physiological sensors. *Id.* at 3–4, 31–32 (citing Ex. 2006, 86:19–87:6; Ex. 2007, 331:19–332:11, 336:11–337:15). Patent Owner concludes Petitioner has failed to establish a reasonable expectation of success because Dr. Kenny's testimony "focuses almost entirely on manufacturing." *Id.* at 32 (citing Ex. 1003 ¶ 91; Ex. 2004 ¶ 75).

Patent Owner moreover asserts Petitioner errs in relying on Nishikawa as supporting the unpatentability of claim 1 because Nishikawa is "not identified as part of" the ground, which, instead, "includes only two references," Aizawa and Inokawa. PO Resp. 33 (citing Pet. 13–14; Ex. 1003 ¶¶ 86–91); *id.* at 34–35 (citing 35 U.S.C. § 312(a)(3); *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016)). Patent Owner asserts Dr. Kenny "relies heavily" on Nishikawa, particularly "to inform the specific shape of the cover in his combination, which is found nowhere in Aizawa and Inokawa." *Id.* at 33–34 (citing Ex. 2004 ¶¶ 76–77; Ex. 2006, 179:21–180:13; Ex. 2007, 364:2–13; Ex. 2008, 73:8–12).

Furthermore, in Patent Owner's view, Dr. Kenny's reliance on Nishikawa "makes no sense" because "Nishikawa's device is not a physiological sensor" but rather is "an encapsulated LED" that "directs ***outgoing*** light through the encapsulation material and thus focuses on the emission of light, not the detection of an optical signal." PO Resp. 35 (citing Ex. 1023, code (57), ¶¶ 3, 32, 35; Ex. 2004 ¶ 78). Patent Owner contrasts such disclosure with Aizawa and Inokawa, both of which "detect[] ***incoming***

light that passes through the cover and reaches the detectors," and which have a "drastically" smaller scale than Nishikawa's LEDs. *Id.* (citing Ex. 1008, Fig. 2; Ex. 2004 ¶ 78).

Petitioner's Reply

In reply, Petitioner insists "Inokawa's lens enhances the light-gathering ability of Aizawa," which would have motivated an ordinarily skilled artisan "to incorporate 'an Inokawa-like lens [having a protrusion] into the cover of Aizawa to increase the light collection efficiency.'" Pet. Reply 2–3 (bolding omitted) (citing Pet. 13–15; Ex. 1003 ¶¶ 86–89; Ex. 1008, Fig. 2, ¶¶ 15, 58). Petitioner dismisses Patent Owner's and Dr. Madisetti's opposition as being "misinformed" because a person of ordinary skill in the art "would understand that Inokawa's lens generally improves 'light concentration at pretty much all of the locations under the curvature of the lens,' as opposed to only at a single point at the center." *Id.* at 3 (quoting Ex. 2006, 164:8–16); Ex. 1047 ¶¶ 7–9.

For example, Petitioner contends that Patent Owner and Dr. Madisetti "ignore[] the well-known principle of reversibility," by which "a ray going from P to S will trace the same route as one from S to P." Pet. Reply 4 (underlining omitted) (citing, e.g., Ex. 1052,[4] 84, 87–92); Ex. 1047 ¶¶ 10–22. Petitioner contends that Dr. Madisetti was evasive when he was asked to apply the reversibility principle to the combination of Aizawa and Inokawa in this case. Pet. Reply 6 (citing Ex. 1034, 89:12–19). Petitioner further

[4] Eugene Hecht, *Optics* (2nd ed. 1990). In referring to Exhibit 1052, Petitioner refers to the document's native page numbering (top corner of each page) and not the added page numbering of the exhibit (bottom, middle of each page). For consistency, we also refer to the native page numbering of Exhibit 1052.

contends that, "based at least on the principle of reversibility," one of ordinary skill in the art "would have understood that both configurations of LEDs and detectors—i.e., with the LED at the center as in Aizawa or with the detector at the center as in Inokawa—would similarly benefit from the enhanced light-gathering ability of an Inokawa-like lens." *Id.* at 9 (citing Ex. 1047 ¶ 22).

Petitioner also asserts that Patent Owner and Dr. Madisetti overlook the fact that light rays reflected by body tissue in the user's wrist, to be received by detectors in either Aizawa's or Inokawa's pulse sensor, will be "scattered" and "diffuse" and, therefore, will approach the detectors "from various random directions and angles." Pet. Reply 9–10, 13 (annotating Inokawa's Fig. 2 to illustrate the cause and nature of the back-scattering); Ex. 1047 ¶¶ 23–26. This scattered and diffuse light, according to Petitioner, means that Inokawa's "lens cannot focus all light toward the sensor's center," as Patent Owner would have it. Pet. Reply 9 (citing Ex. 1047 ¶ 23; Ex. 2006, 163:12–164:2). Petitioner asserts this is due to Snell's law, and provides several illustrations to illustrate why. *Id.* at 9–15 (citing, e.g., Ex. 1047 ¶¶ 23–34).

Due to the random nature of this scattered light, Petitioner explains that one of ordinary skill in the art would have understood that a convex cover "provides a slight refracting effect, such that light rays that may have missed the detection area are instead directed toward that area." Pet. Reply 10 (citing Ex. 1047 ¶¶ 25–26). Petitioner applies this understanding to Aizawa, and contends that using a lens with a convex protrusion in Aizawa would "enable backscattered light to be detected within a circular active detection area surrounding" a central light source. *Id.*

Moreover, Petitioner dismisses the applicability of Figure 14B of the ’191 patent as illustrating the operation of a *transmittance*-type of sensor that measures the attenuation of collimated light transmitted through the user’s body tissue, rather than the *reflectance*-type sensor of Aizawa. *Id*. at 11–13 (citing, e.g., Ex. 1001, 36:11–13; Ex. 1047 ¶¶ 27–31).

Petitioner further maintains that Patent Owner’s argument that Petitioner’s illustrations of the light-focusing properties of a convex lens discussed in the Petition filed in IPR2020-01520 (Ex. 2019, 39) and relied upon by Dr. Kenny (Ex. 2020 ¶¶ 119–120) do not demonstrate “that a convex lens directs all light to the center.” Pet. Reply 15 (citing PO Resp. 16–18, 23). Petitioner contends these illustrations, instead, “are merely simplified diagrams included to illustrate . . . one example scenario (based on just one ray and one corpuscle) where a light permeable cover can ‘reduce a mean path length of light traveling to the at least four detectors’” as recited in claim 12 of the patent challenged in that proceeding. *Id.* (citing, e.g., Ex. 1047 ¶ 34).

<u>Patent Owner’s Sur-reply</u>

Patent Owner asserts that Petitioner’s Reply improperly presents several new arguments, relying on new evidence, as compared with the Petition. *See, e.g.*, PO Sur-reply 1 (“new optics theories” and “new arguments”), 2, 6, 7, 9, 10, 12, 13.

Patent Owner also contends that Petitioner mischaracterizes Patent Owner’s position, which is not that Inokawa’s lens with a convex protrusion “would direct ‘***all***’ light ‘only at a ***single point*** at the center’” of the sensor. *Id.* at 2, n.2 (quoting Pet. Reply 3; citing, e.g., Ex. 2027, 63:7–64:6, 94:20–96:1, 96:18–97:7). Patent Owner’s position, rather, is that Inokawa’s lens

condenses more light (not necessarily all light) "***towards the center*** of the sensor" as compared to a flat surface. *Id.* at 2 (quoting PO Resp. 18; citing, e.g., Ex. 2004 ¶¶ 34, 43, 49, 51–52, 54–55, 67).

Patent Owner moreover asserts "[t]here can be no legitimate dispute that a convex surface directs light centrally (and away from the periphery)." PO Sur-reply 3–6 (citing PO Resp. 15–18; Ex. 2006, 164:8–16, 166:10–17, 170:22–171:5; Ex. 2020 ¶¶ 119, 200; Ex. 2027, 181:9–182:5). Patent Owner contends that Petitioner's argument "that Inokawa would improve light-gathering at all locations, ***regardless*** of the location of the LEDs and detectors" is belied by Dr. Kenny's testimony that "Inokawa's benefit would ***not*** be clear if Inokawa's LEDs and detectors were moved" and "confirmed that a convex surface would direct light toward the center of the underlying sensor." *Id.* at 6 (citing Pet. Reply 3–4; Ex. 2006, 86:19–87:6, 202:11–204:20).

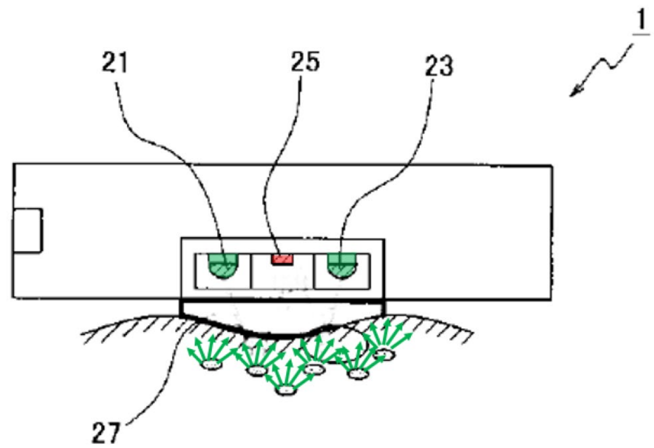
Patent Owner argues that Petitioner's discussion of the principle of reversibility is "irrelevant" because it "assumes ideal conditions that are not present when tissue scatters and absorbs light." PO Sur-reply 6–8 (citing Ex. 2027, 17:12–19:2, 29:11–30:7, 31:8–32:3, 38:17–42:6, 207:9–209:21, 210:8–6). The random nature of backscattered light, in Patent Owner's view, "hardly supports Petitioner's argument that light will necessarily travel the same paths regardless of whether the LEDs and detectors are reversed," and is irrelevant to the central issue presented here of "whether a convex surface—***as compared with a flat surface***—would collect and focus additional light on Aizawa's peripherally located detectors." *Id.* at 8–9 (citing Ex. 2027, 212:3–14).

Patent Owner also argues that Petitioner's position that a convex cover will provide a "***slight***" refracting effect, "directly undermines Petitioner's provided ***motivation*** to combine," i.e., to enhance light collection efficiency. *Id.* at 10–11.

Analysis

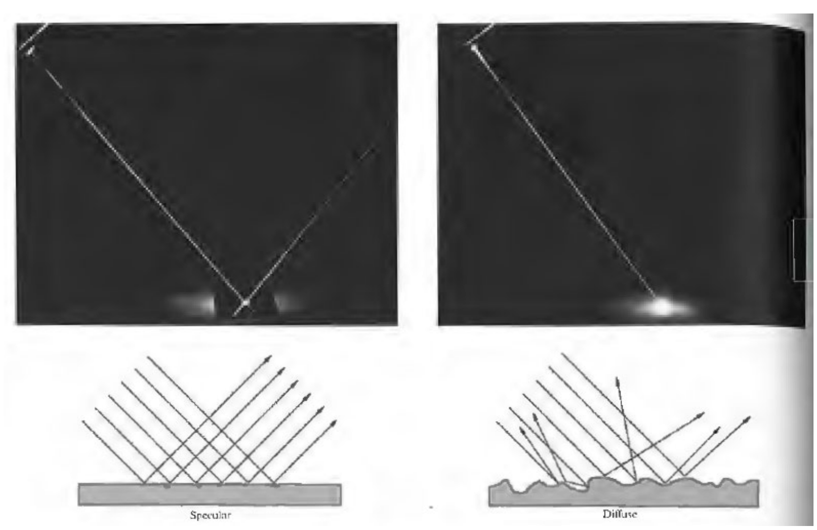
Upon review of the foregoing, we conclude that a preponderance of the evidence supports Petitioner's view that it would have been obvious to modify Aizawa's cover 6 to include a lens with a single outwardly protruding convex surface like that taught in Inokawa, in order to increase the amount of backscattered light that will be received by Aizawa's four peripheral detectors 22, as compared with Aizawa's existing flat cover.

It is clear that Aizawa's and Inokawa's pulse sensors both gather data by emitting light into the user's wrist tissue and collecting light that reflects back to the sensor from the user's tissue. *See, e.g.*, Ex. 1006, Figs. 1(b), 2 (sensor 2 has emitter 21 and four detectors 22, all facing a user's wrist 10); Ex. 1008, Figs. 1, 2 (sensor 1 has two emitters 21, 23 and one detector (photodiode 25), all facing the user's wrist when held in place by wristband 5). Dr. Kenny testifies, and Patent Owner agrees, that the reflection of this light by the user's wrist tissue randomizes the propagation direction of the reflected light rays. *See* Ex. 1047 ¶¶ 12, 14–17, 23; Ex. 2020 ¶ 128; PO Sur-reply 7 ("Even Petitioner admits that tissue randomly scatters and absorbs light rays . . . ."). This reflection principle is illustrated by Dr. Kenny's annotations to Inokawa's Figure 2 reproduced below:



Here, Dr. Kenny has modified Inokawa's Figure 2 by (1) removing two black arrows, (2) coloring Inokawa's light detector in red and Inokawa's two light emitters in green, and (3) adding several green arrows to illustrate the various directions that light rays may be directed after impinging on and reflecting off different tissues in the user's wrist. Ex. 1047 ¶ 32.

This randomized direction of reflected light rays results in backscattered light that is diffuse, rather than collimated, in nature. Figure 4.12 of Exhibit 1052 illustrates the difference between diffuse and collimated light, and is reproduced below:



This figure provides at left a photograph and an illustration showing incoming collimated light reflecting from a smooth surface, and at right a

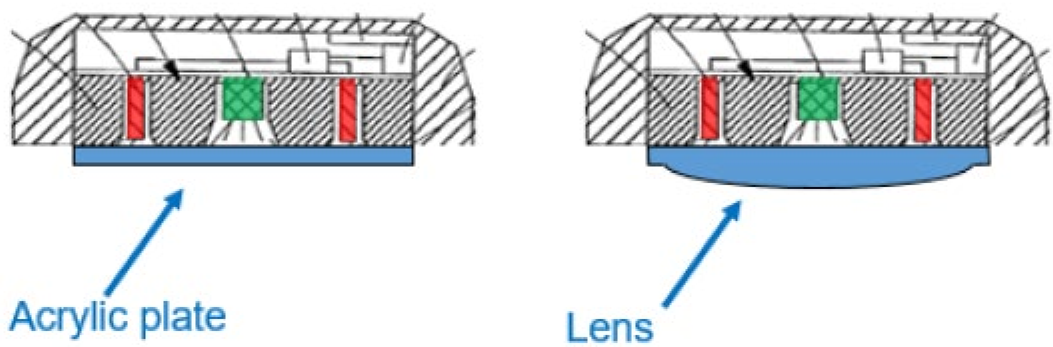
photograph and an illustration of incoming collimated light reflecting from a rough surface. *See* Ex. 1052, 87–88. The smooth surface provides specular reflection, in which the reflected light rays are collimated like the incoming light rays. *See id.* The rough surface provides diffuse reflection, in which the reflected light rays travel in random directions. *See id.*

This diffuse nature of the light reflected from the user's wrist tissue, which both Aizawa and Inokawa aim to collect to generate pulse data, suggests that a lens might be useful to increase the amount of collected light and thereby increase the reliability of the pulse data generated using the collected light. Indeed, that is taught by Inokawa. Inokawa describes using its lens 27 to "increase the light-gathering ability" of Inokawa's light photodiode or detector 25.[5] Ex. 1008 ¶¶ 15, 58. Furthermore, there is also no dispute that Inokawa's lens 27 is understood to be shaped to include a single convex protruding surface. *See, e.g.*, Ex. 1003 ¶¶ 87–88 (characterizing Inokawa as teachings a "convex protrusion that acts as a lens"); PO Resp. 1 (describing Inokawa as teaching a "convex lens"). Thus, Inokawa demonstrates that it was known in the art to use a lens comprising a single convex protrusion to focus diffuse light reflected from body tissue on to the light detecting elements of a wrist-worn pulse sensor, and to increase the light gathered by the sensor thereby improving the device's calculation of the user's pulse.

A preponderance of the evidence supports Petitioner's view that it would have been obvious for a person of ordinary skill in the art to apply

[5] Although Inokawa refers to the "LED" such as emitters 21, 23 in that regard (Ex. 1008 ¶ 15), rather than photodiode 25, it is undisputed that photodiode 25 is the only component of Inokawa's sensor 1 that gathers light.

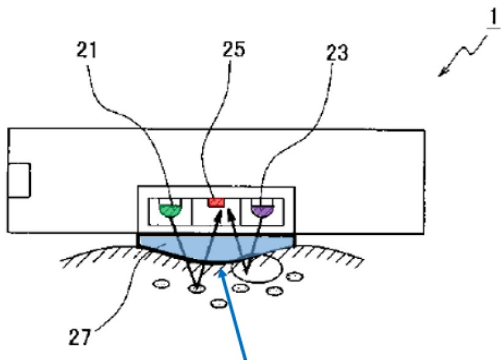
Inokawa's lens technology to Aizawa's wrist-worn pulse sensor to similarly improve its light collection as compared to Aizawa's existing flat cover. That is depicted in the following illustrations provided by Dr. Kenny:

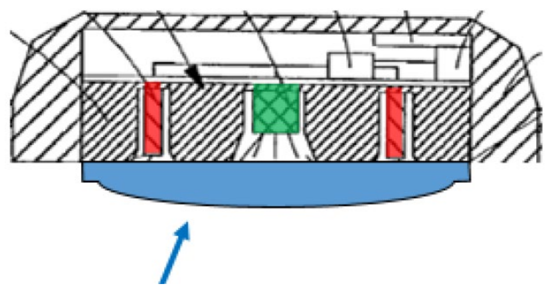


The illustration at left modifies Aizawa's Figure 1(b) to color Aizawa's emitter in green, its detectors in red, and Aizawa's existing flat cover in blue; the illustration on the right includes Aizawa's Figure 1(b) with the same color coding, but wherein the flat cover is modified to incorporate a convex protrusion that covers Aizawa's peripheral light detectors and central light emitter. *See* Ex. 1003 ¶ 89. We are persuaded by Dr. Kenny's testimony that Snell's law indicates that "light rays that may have otherwise missed the detection area are instead directed toward that area as they pass through the interface provided by the cover," and is especially true "in configurations like Aizawa's in which light detectors are arranged symmetrically about a central light source, so as to enable backscattered light to be detected within a circular active detection area surrounding that source." Ex. 1047 ¶ 26; *see also id.* ¶¶ 23–26.

Patent Owner correctly notes that Inokawa's single detector 25 is located in the central portion of Inokawa's sensor 1, whereas Aizawa's four detectors 22 are located towards the periphery of Aizawa's sensor 2. *Compare* Ex. 1008, Fig. 2, *with* Ex. 1006, Figs. 1(a)–1(b). Nevertheless,

Petitioner's proposed modification of Aizawa takes that arrangement into account, as can be seen by the following comparison between Inokawa's sensor and Petitioner's proposed modification of Aizawa's sensor:





The illustration at left annotates Inokawa's Figure 2 to identify the central detector in red and the lens in blue (*see* Ex. 1003 ¶ 87), and the illustration at right annotates Petitioner's proposed modification of Aizawa to illustrate the peripheral detectors in red and the lens in blue (*see id.* ¶ 89). As can be seen, the lenses are not identical. In Inokawa the lens's curvature is most pronounced at the center of the lens near the central detector, and in the proposed modification to Aizawa, the lens's curvature is most pronounced at the edges of the lens near the peripheral detectors. Thus, Dr. Kenny's proposed modification of Aizawa takes Inokawa's general teaching of using a convex protruding lens to increase the amount of incoming light directed to a light detector, and applies it to the light detectors of Aizawa. *See, e.g.*, Ex. 1003 ¶ 88 ("[B]ecause the path of light is reversible, the light collection function of Inokawa's lens would work the same way regardless of whether light is emitted toward the center (and detected by a centrally located photodiode) or emitted away from the center (and detected by a peripherally located photodiode)."), 90 ("That is, depending on the desired objective of the user (e.g., less scratches or improved light-gathering), the shape of the cover can be readily modified."), 91 ("[T]o achieve the goal of

improving light collection efficiency, which both Aizawa and Inokawa share, a [person of ordinary skill in the art] would have been able to, with a reasonable expectation of success, modify Aizawa's light permeable cover to have a lens as taught by Inokawa."); Ex. 1047 ¶¶ 7–34.

We are cognizant of Patent Owner's contention that Petitioner's ground "improperly" relies upon a reference, Nishikawa, that was not identified as a part of the ground of unpatentability. PO Resp. 33. As Patent Owner observes, Dr. Kenny characterizes his testimony as being "***inspired* by**" or "motivated" in part based on Nishikawa's disclosure when it comes to the shape of a convex lens. *See, e.g.*, PO Resp. 34–36 (citing, e.g., Ex. 2007, 364:2–13; Ex. 2008, 73:8–12). We, however, disagree with Patent Owner that any impropriety arises from Dr. Kenny's contemplation of the teachings of Nishikawa in connection with the shape of a lens for a physiological sensor. The nature of Petitioner's and Dr. Kenny's consideration of Nishikawa is explained in cited portions of Dr. Kenny's declaration, even if Nishikawa is not listed as a third reference in the identification of the ground. *See* Ex. 1003 ¶ 91 ("[M]any prior art references of this period, such as Nishikawa (shown below) demonstrate exactly how such a lens shape [as taught by Inokawa] may be incorporated into a molded cover."); Pet. 16. Indeed, it follows readily from the Petition that a skilled artisan would have appreciated that Nishikawa's teachings provide insight as to how "the transparent acrylic material used to make Aizawa's plate can be readily formed into a lens structure as in Inokawa." Pet. 16. Nishikawa describes how its "lens unit 50" can be a transparent resin formed in the shape illustrated in Figure 6 by injection molding. Ex. 1023 ¶¶ 22, 32, 35. Dr. Kenny also explains that Nishikawa's lens shape design "is intended to

provide curvature in the lens where it can do the most good and otherwise try to avoid excess use of material in order to create curvature in locations where it wouldn't do any good." Ex. 2006, 179:21–180:13.

Moreover, we observe that a rejection based on obviousness "require[s] an analysis that reads the prior art in context, taking account of 'demands known to the design community,' 'the background knowledge possessed by a person having ordinary skill in the art,' and 'the inferences and creative steps that a person of ordinary skill in the art would employ.'" *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (quoting *KSR*, 550 U.S. at 418). Furthermore, record evidence can be useful to "demonstrate the knowledge and perspective one of ordinary skill in the art." *Id.*; *see also Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015) ("Art can legitimately serve to document the knowledge that skill artisan would bring to bear in reading the prior art identified as producing obviousness.").

As noted above, Dr. Kenny makes clear that his view as to obviousness of the claims of the '191 patent was "inspired by" or "motivated" in part by Nishikawa's teachings as to shapes generally known to those in the art of manufacturing a lens. *See, e.g.*, Ex. 2007, 364:2–13; Ex. 2008, 73:12–21. We conclude that the record establishes that Nishikawa's teachings are representative of background knowledge of one of ordinary skill in the art and provide context and perspective of a skilled artisan as to the type of shapes available for a convex protruding surface, such as that disclosed in Inokawa. That Dr. Kenny considered record evidence cited in the Petition as informing his view of what a skilled artisan

would understand as to known types of lens shapes does not establish, in our view, any impropriety as part of that ground.

Patent Owner additionally asserts, and Dr. Madisetti testifies, that Petitioner's combination of Aizawa and Inokawa is "problematic" because it overlooks the "small" size of Aizawa's detectors 22 and the openings or cavities 23c in which they are housed. *See* PO Resp. 21 (citing Ex. 1006, Fig. 1(a); Ex. 2004 ¶ 63). Patent Owner, however, does not articulate what significance the size of Aizawa's detector components have in the obviousness evaluation based on the teachings of the prior art.

We additionally do not agree with Patent Owner's argument that Petitioner's Reply presents new arguments and evidence that should have been first presented in the Petition. The Petition proposed a specific modification of Aizawa to include a convex protrusion in the cover, for the purpose of increasing the light gathering ability of Aizawa's device. *See, e.g.*, Pet. 13–17. Patent Owner, in its Response, challenged that contention with several arguments that Petitioner's proposed convex protrusion would not operate in the way the Petition alleged. *See, e.g.*, PO Resp. 15–36. In its Reply, Petitioner provided arguments and evidence attempting to rebut the contentions in the Patent Owner Response. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019),[6] 73 ("A party also may submit rebuttal evidence in support of its reply."). The Reply does not change Petitioner's theory for obviousness; rather, the Reply presents more argument and evidence in support of the same theory for obviousness presented in the Petition. *Compare* Pet. 13–17, *with* Pet. Reply 2–15.

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[6] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

Patent Owner finally argues that a conclusion of obviousness "strains credibility" because the level of ordinary skill in the art (*see supra* Section II.C) does not require specific education or experience with optics or optical physiological monitors. *See, e.g.*, PO Resp. 31. We disagree. Concerning motivation, the record demonstrates that an ordinarily skilled artisan would have readily appreciated that: (1) Aizawa's detector 1 operates by gathering light data with its photodetectors 22; (2) a lens was known to focus light on photodetectors; and (3) optical lenses may be formed by providing a convex protrusion in the lens to focus light. Indeed, Inokawa discloses such utility, function, and structure as a part of its convex lens. *See, e.g.*, Ex. 1008 ¶¶ 15, 58, Fig. 2. We are persuaded that a person of ordinary skill in the art would have understood these general concepts of optics.

Concerning reasonable expectation of success, we rely on Dr. Kenny's testimony that a person of ordinary skill in the art "would have sought to incorporate a convex lens as in Inokawa into Aizawa's acrylic plate to thereby increase light collection efficiency, in turn leading to more reliable pulse wave detection," "would have further understood *how* to" do so, "depending on the desired objective of the user," and would have enjoyed a reasonable expectation of success in doing so. Ex. 1003 ¶¶ 88, 90–91; Ex. 2006, 179:21–180:13, 202:11–20.

Thus, we conclude that one of ordinary skill in the art would have had adequate reason to replace Aizawa's flat cover 6 with a cover comprising a convex protrusion, to improve light detection efficiency, and would have had a reasonable expectation of success in doing so.

vi. Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

4. Independent Claim 9

Independent claim 9 consists of limitations that are substantially similar to elements [a]–[d] of claim 1. *Compare* Ex. 1001, 44:50–67, *with id.* at 45:26–36 (reciting a "planar surface"; "at least four detectors" arranged in a "grid pattern" on the planar surface; and "a lens forming a cover of the housing"). In asserting that claim 9 also would have been obvious over the combined teachings of Aizawa and Inokawa, Petitioner refers to substantially the same arguments presented as to claim 1. *See* Pet. 35–38; Ex. 1003 ¶¶ 106–113.

Patent Owner does not present any argument for this claim other than those we have already considered with respect to independent claim 1. PO Resp. 12–42.

For the same reasons discussed above, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 9 would have been obvious over the cited combination of references. *See supra* II.D.3.i–v; Ex. 1003 ¶¶ 106–113.

5. Dependent Claims 2–6, 8, 10–16, 18, and 19

Petitioner presents undisputed contentions that claims 2–6, 8, 10–16, 18, and 19, which depend directly or indirectly from independent claim 1 or 9, are unpatentable over the combined teachings of Aizawa and Inokawa,

and provides arguments explaining how the references teach the limitations of these claims. Pet. 29–34, 38–43; Ex. 1003 ¶¶ 94–105, 114–124.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1. PO Resp. 42 ("The Petition fails to establish that independent claims 1 and 9 would have been obvious . . . and thus fails to establish obviousness as to any of the challenged dependent claims.").

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–6, 8, 10–16, 18, and 19 would have been obvious over the combined teachings of the cited references and as supported by the testimony of Dr. Kenny.

E. Obviousness over the Combined Teachings of Mendelson-1988 and Inokawa

Petitioner contends that claims 1–6, 8–16, 18, and 19 of the '191 patent would have been obvious over the combined teachings of Mendelson-1988 and Inokawa. Pet. 46–70.

1. Overview of Mendelson-1988 (Ex. 1015)

Mendelson-1988 discloses a pulse oximeter, with an optical reflectance sensor suitable for noninvasive monitoring of a user's arterial hemoglobin oxygen saturation (SpO_2), via the user's forehead. *See* Ex. 1015, 167 (title & abstract). Figure 2 is reproduced below:

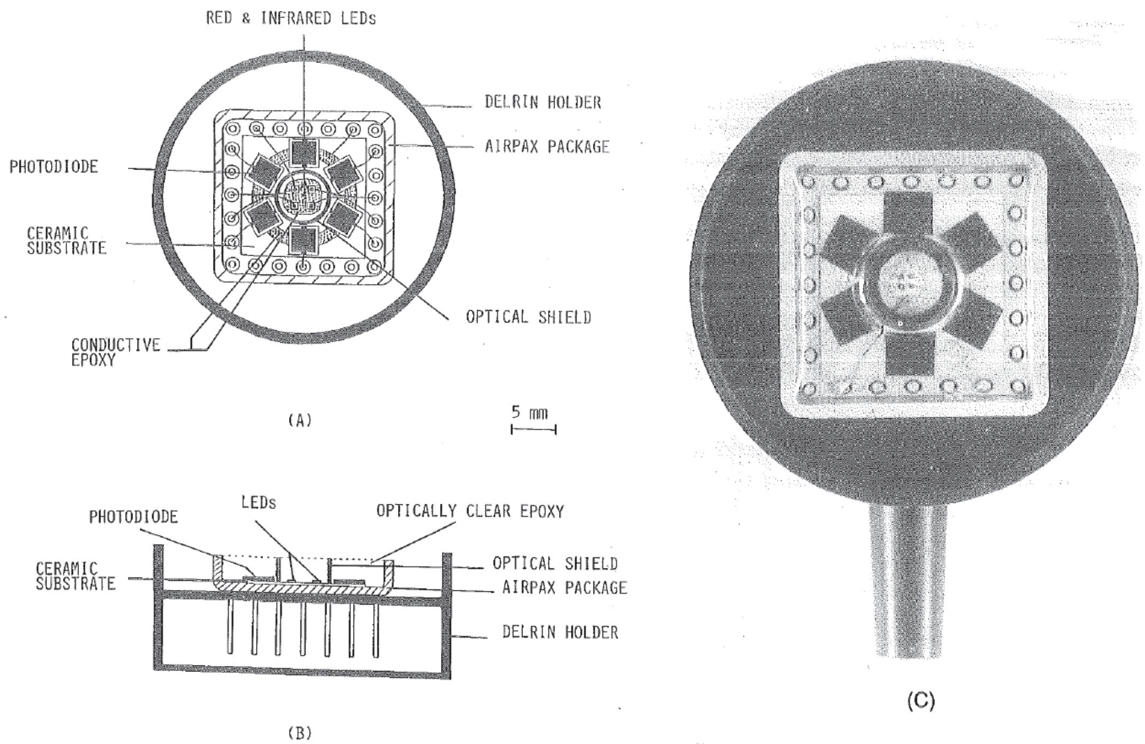


Figure 2 illustrates the sensor of Mendelson-1988, including: (A) a top view diagram; (B) a side view diagram; and (C) a photograph. *Id.* at 169.

The sensor includes two red LEDs and two infrared LEDs for emitting light into the user's tissue, and six photodiodes "arranged symmetrically in a hexagonal configuration" surrounding the four emitters, to detect light reflected back to the sensor from the user's tissue. *Id.* at 168 ("SENSOR DESIGN"). The user's "SpO_2 can be calculated from the ratio of the reflected red and infrared photoplethysmograms." *Id.* at 167. "To minimize the amount of light transmission and reflection between the LEDs and the photodiodes within the sensor, a ring-shaped, optically opaque shield of black Delrin . . . was placed between the LEDs and the photodiode chips." *Id.* at 168 (col. 2). "The optical components were encapsulated inside the package using optically clear adhesive." *Id.* "The microelectronic package was mounted inside a black Delrin housing." *Id.*

2. Independent Claim 1

Petitioner contends that claim 1 would have been obvious over the combined teachings of Mendelson-1988 and Inokawa. Pet. 47–51 (combination), 51–56 (claim 1).

i. "A noninvasive optical physiological sensor comprising"

The cited evidence supports Petitioner's undisputed contention that Mendelson-1988 discloses a noninvasive optical physiological sensor, i.e., an "optical reflectance sensor" that monitors "arterial hemoglobin oxygen saturation," a physiological parameter of the wearer. Pet. 51; *see, e.g.*, Ex. 1015, Abstract, 167, 172; Ex. 1003 ¶ 130.

ii. "[a] a plurality of emitters configured to emit light into tissue of a user"

The cited evidence supports Petitioner's undisputed contention that Mendelson-1988 discloses two red LEDs and two infrared LEDs that emit light into user tissue. Pet. 51; *see, e.g.*, Ex. 1015, 168 ("The optical reflectance sensor used in this study consists of two red (peak emission wavelength: 660 nm) and two infrared (peak emission wavelength: 930 nm) LED chips.")), Fig. 2(a); Ex. 1003 ¶ 131.

iii. "[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors"

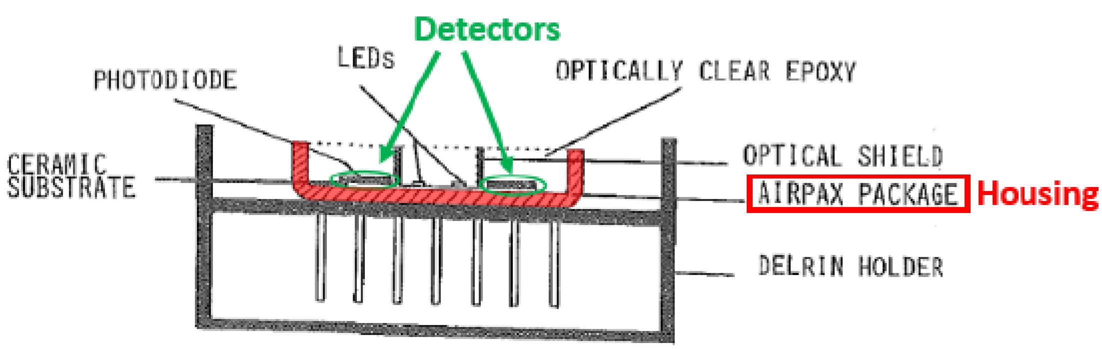
The cited evidence supports Petitioner's undisputed contention that Mendelson-1998 discloses "six silicon photodiodes . . . arranged symmetrically in a hexagonal configuration" on the sensor. Pet. 52; *see,*

e.g., Ex. 1015, 168–169, Figs. 2(A)–(B). Mendelson-1998 discloses that the photodiodes output "current pulses" indicative of a physiological parameter of the wearer in response to light emitted by the emitters and reflected from the skin. Pet. 52; *see, e.g.*, Ex. 1015, 167 ("SpO_2 can be calculated from the ratio of the reflected red and infrared photoplethysmograms."); Ex. 1003 ¶ 132.

> iv. *"[c] a housing configured to house at least the plurality of detectors in a circular portion of the housing"*

<u>Petitioner's Undisputed Contentions</u>

The cited evidence supports Petitioner's contention that Mendelson-1988 discloses an AIRPAX package, i.e., a housing in which the detectors are located. Pet. 60; Ex. 1015, 168. Petitioner's annotated version of Mendelson-1988's Figures 2B is reproduced below.



Pet. 53. The modified figure depicts a side view of Mendelson-1988's sensor with a housing (depicted in red) in which the detectors (depicted in green) are located. *Id.*; Ex. 1003 ¶ 133.

<u>Petitioner's Disputed Contentions</u>

Petitioner contends that although the housing of Mendelson-1998 appears to have a square shape, not a circular one, a person of ordinary skill

in the art "would have recognized that microelectronic packaging as used in Mendelson-1988 comes in various shapes and sizes," and that such an artisan "would have considered using a differently shaped housing, namely a circular one, to be obvious" because a circular housing was common and the shape would have imparted nothing new or inventive. Pet. 54–55 (citing, e.g., Ex. 1003 ¶¶ 134–135). For example, Petitioner relies on Mendelson-799,[7] which discloses a sensor for an optical measurement device having a circular shape. *Id.* (citing Ex. 1025, Fig. 7, 9:34–36).

<u>Patent Owner's Arguments</u>

Patent Owner argues that Mendelson-1988 and Inokawa provide square housings for their components. PO Resp. 52–53. According to Patent Owner, "[t]he Petition never identifies a motivation to pick a circular-shaped housing instead of the existing square shape" and that a skilled artisan would not have made such a modification without some perceived benefit for doing so. *Id.* at 53–54 (citing, e.g., Ex. 2004 ¶ 118). Patent Owner objects to Petitioner's reliance on the sensor shape taught by Mendelson-799 because (1) Mendelson-799 is not included in any ground, and (2) Mendelson-799 does not disclose a cover and, as such, cannot disclose the combined claim features. *Id.* at 54.

<u>Petitioner's Reply</u>

In its Reply, Petitioner contends that "neither the '191 patent nor [Patent Owner] provides any explanation of how the particular housing shape solves some problem or presents some unexpected result." Pet. Reply 26.

[7] U.S. Patent No. 6,801,799 B2 ("Mendelson-799," Ex. 1025).

Patent Owner's Sur-reply

In its Sur-reply, Patent Owner reiterates its positions from its Response. PO Sur-reply 23.

Analysis

We are persuaded by Petitioner's contentions. Mendelson-1988 discloses a housing in the form of an AIRPAX package that has a square shape when viewed from above. *See* Ex. 1015, Fig. 2(A). Petitioner's and Dr. Kenny's general assessment that a person of ordinary skill in the art would have been aware that a circular housing shape was a known option for housing components of a physiological sensor finds support in the record. Pet. 53–55; Ex. 1003 ¶¶ 133–135. In that respect, although Mendelson-799 was not listed in the styling of the proposed grounds of unpatentability based on Mendelson-1988 and Inokawa, its teachings plainly were offered in the Petition as evidence of the background knowledge that an ordinarily skilled artisan would have brought to bear in an evaluation of the teachings Mendelson-1988 and Inokawa. Pet. 54. Moreover, it is clear that Patent Owner understood that the proposed ground offered in the Petition considered the disclosure of Mendelson-799, and Patent Owner had opportunity to address that disclosure. Indeed, Patent Owner availed itself of that opportunity during trial (*see, e.g.*, PO Resp. 52–54; PO Sur-reply 23).

We further find unavailing Patent Owner's argument that "Mendelson[-]799 does not disclose a cover (or even epoxy encapsulation)." PO Resp. 54. Figure 7 of Mendelson-799 is reproduced below:

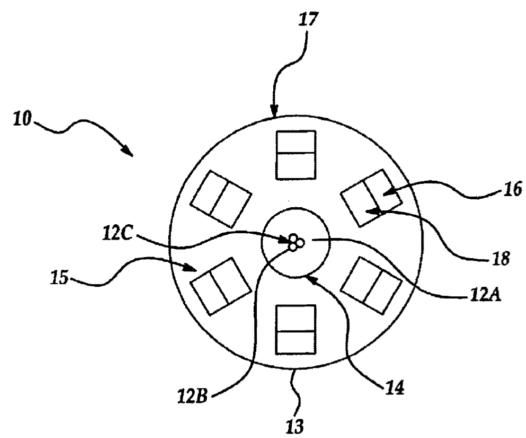


Figure 7

Figure 7 is a top view of optical sensor 10 comprising light source 12 composed of three LEDs 12A, 12B, and 12C emitting light of three different wavelengths, and an array of six near detectors 18 and six far detectors 16 "arranged in two concentric ring-like arrangements" surrounding light source 12. Ex. 1025, 9:23–34. "All these elements are accommodated in a sensor housing 17" which, as can be seen in Figure 7, is clearly circular. *Id.* at 9:34–35. Patent Owner does not articulate why the presence or absence of a cover in Mendelson-799 somehow serves to discount the unambiguous presentation of a sensor housing having a circular shape.

Furthermore, one of ordinary skill in the art would have understood that the AIRPAX package of Mendelson-1988 and the housing 17 of Mendelson-799 are performing the same function of enclosing a central collection of light emitters which are surrounded by an array of light detectors in an optical sensor attached to a user's body. *See, e.g.*, Ex. 1015, Figs. 2A–2B; Ex. 1025, Fig. 7. The evidence of record also does not suggest that the shape of such a housing has any functional significance in the operation of the optical sensor, or that any particular known shape was preferred or restricted. Thus, the evidence suggests that a square shape and a circular shape of such a housing were known in the art to be predictable

substitutes for one another, and therefore obvious variants. *See, e.g.*, *KSR*, 550 U.S. at 416 ("[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result."); *id.* at 417 ("[W]hen a patent 'simply arranges old elements with each performing the same function it had been known to perform' and yields no more than one would expect from such an arrangement, the combination is obvious." (citation omitted)).

Thus, we conclude a person of ordinary skill in the art would have found it obvious to modify the square shape of Mendelson-1988's sensor to be circular, and would have had a reasonable expectation of success in doing so.

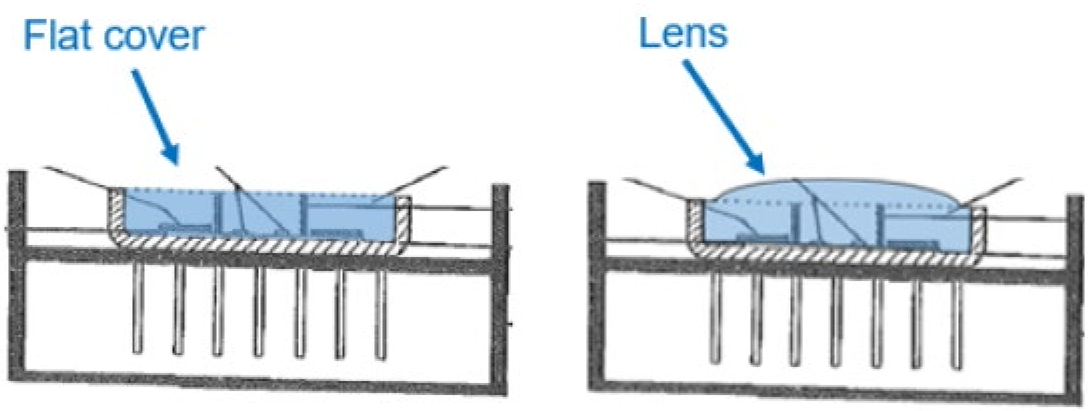
v. "[d] a lens configured to be located between tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor is worn by the user and during operation of the noninvasive optical physiological sensor"

Petitioner's Contentions

Petitioner contends that Mendelson-1988's sensor discloses a light permeable cover, i.e., the "OPTICALLY CLEAR EPOXY" in Figure 2B, that covers the detectors and is located between the user's tissue and the detectors when worn. Pet. 47, 55–56; Ex. 1003 ¶¶ 67, 136–145. Petitioner states that Mendelson-1998 does not provide further details, such as the "precise shape of this layer's interface with the skin." Pet. 47; Ex. 1003

¶ 137. As discussed above in Section II.D.3, Petitioner contends that Inokawa's sensor includes lens 27 positioned over light detector 25. Pet. 65. Petitioner reasons that an ordinarily skilled artisan would have been motivated, with a reasonable expectation of success, to modify Mendelson-1988's optical SpO_2 sensor, in light of Inokawa's optical pulse sensor, by adding a lens with a single outwardly protruding convex surface to Mendelson-1988's cover to improve the sensor's light detection efficiency. *Id.* at 48–49.

Dr. Kenny provides the following illustrations to portray the proposed modification of Mendelson-1988's sensor (Ex. 1003 ¶¶ 140–141):



At the left, Dr. Kenny has excerpted and annotated Mendelson-1988's Figure 2B, to identify the pre-existing cover (colored blue) which covers the light emitters and detectors. *See id.* At the right, Dr. Kenny has illustrated the device resulting from the proposed modification of the cover to have a single convex protrusion (also colored blue). *See id.*

Petitioner adds that a person of ordinary skill in the art would have had a reasonable expectation of success in implementing Inokawa's lens structure in Mendelson-1998, and that the modification would have "require[d] only routine knowledge of sensor design and assembly."

Pet. 59–60; Ex. 1003 ¶ 142. For example, Petitioner contends that prior art to Nishikawa demonstrates that "molding clear epoxy, as in Mendelson-1988, into a lens was well understood." Pet. 50 (citing Ex. 1023, Fig. 6, ¶¶ 22, 32, 35; Ex. 1003 ¶ 143). Indeed, Petitioner notes that Mendelson-1998 and Nishikawa utilize the same material, which "can have the same index of refraction, and, as such, the interface between the encapsulation portion and the lens portion will not adversely affect the optical performance of the modified system." *Id.* (citing Ex. 1023 ¶ 37; Ex. 1003 ¶ 144).

Finally, Petitioner contends that "[a]ttaching a rigid device," as suggested by the proposed combination of Mendelson-1998 and Inokawa, "in such a manner will cause at least some deformation of the tissue to occur because the skin is more pliable than the cover," such that the modified sensor and lens "acts to further deform the tissue of the user around the convex surface of the lens when the device is pressed against the tissue." Pet. 56; Ex. 1003 ¶ 145.

<u>Patent Owner's Arguments</u>

Patent Owner is of the view that Petitioner has not met its burden to demonstrate the obviousness of modifying Mendelson-1988's sensor in light of Inokawa to have a protrusion, based on substantially the same analysis and testimony discussed above in the context of combining Aizawa and Inokawa. *See* PO Resp. 46–50; Ex. 2004 ¶¶ 98–109; *supra* Section II.D.3.v. For example, Patent Owner argues that Mendelson-1988, like Aizawa, provides central emitters surrounded by several peripherally located detectors. *Compare* Ex. 1015, 169 (Fig. 2) (showing four central LEDs surrounded by six photodiodes), *with* Ex. 1006, Figs. 1(a)–1(b) (showing

one central LED 21 surrounded by four photodetectors 22); PO Resp. 46. Given this arrangement, Patent Owner reiterates its argument that the proposed combination in view of Inokawa would direct light away from the peripheral detectors, and toward the center of the sensor, thereby diminishing the received signal. PO Resp. 48–50.

Additionally, and as discussed above in the context of combining Aizawa and Inokawa, Patent Owner argues that Petitioner improperly relies upon Nishikawa's teachings, although Nishikawa is not identified as part of the asserted ground of unpatentability. PO Resp. 54–55.

Petitioner's Reply

Petitioner incorporates its contentions as set forth regarding the proposed combination of Aizawa and Inokawa, and responds that Dr. Kenny's consideration of Nishikawa was proper, as providing further support for the proposed combination. Pet. Reply 23, 26–27.

Patent Owner's Sur-reply

Patent Owner's Sur-reply generally reiterates its arguments challenging Petitioner's contentions. PO Sur-reply 20–24.

Analysis

As an initial matter, we find that a preponderance of the evidence establishes that the Mendelson-1988 sensor's optically clear epoxy is a light permeable cover that is arranged above a portion of the housing and covers the sensor's detectors.[8] In particular, it is clear from Figures 2A and 2B that the epoxy extends from the top of the sensor at the dotted line in the figure, down into the well of the AIRPAX package, to cover all four LEDs and all six photodiodes disposed at the bottom of the well. *See also* Ex. 1015, 168

[8] We note that claim 1 does not recite a "cover." *See supra* § II.A.1.

("The optical components were encapsulated inside the package using optically clear adhesive.").

We also conclude that a preponderance of the evidence supports Petitioner's contention that it would have been obvious to modify the top surface of Mendelson-1988's epoxy to include a lens including a single convex protruding surface, in order to increase the amount of backscattered light that will be received by Mendelson-1988's peripheral detectors. Our reasoning is substantially identical to the analysis provided above in connection with the ground based on Aizawa and Inokawa, with Mendelson-1988 replacing Aizawa in the combination. *See supra* Section II.D.3. Patent Owner does not cite, and we do not discern, any material difference between Mendelson-1988 and Aizawa that might lead to a different result here. For the reasons discussed in Section II.D.3, we do not agree with Patent Owner's arguments that the proposed combination would result in a diminished sensor signal, or that Petitioner improperly relied upon Nishikawa.

vi. Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

3. Independent Claim 9

Independent claim 9 consists of limitations that are substantially similar to elements [a]–[d] of claim 1. *Compare* Ex. 1001, 44:50–67, *with id.* at 45:26–36 (reciting a "planar surface"; "at least four detectors" arranged in a "grid pattern" on the planar surface; and "a lens forming a

cover of the housing"). In asserting that claim 9 also would have been obvious over the combined teachings of Mendelson-1988 and Inokawa, Petitioner refers to substantially the same arguments presented as to claim 1. *See* Pet. 63–66; Ex. 1003 ¶¶ 160–165. Specifically, regarding the recitation of "a lens forming a cover of the housing," Petitioner maintains that "Mendelson-1988-Inokawa renders obvious" this limitation and incorporates its contentions from claim 1. Pet. 66; Ex. 1003 ¶ 165.

Regarding claim 9, Patent Owner largely relies upon arguments we have already considered with respect to independent claim 1. PO Resp. 46–56. Additionally, Patent Owner argues that Petitioner's proposed combination does not include the claimed "cover" because Mendelson-1988 encapsulates its components in optically clear adhesive/epoxy, which is not a "cover." PO Resp. 46, 51–52. Patent Owner contends that the '191 patent distinguishes between resin and covers. *Id.* at 51 (citing Ex. 1001, 36:50–60). Patent Owner also argues that Nishikawa, on which Petitioner relies, "never identifies its resin as a cover," and instead "discusses encapsulation of components using an integrally molded resin." *Id.* at 52 (citing Ex. 1023 ¶ 35). Likewise, Patent Owner characterizes Inokawa's cover as a "***distinct structure***, not an undifferentiated mass of resin on a surface." *Id.* (citing Ex. 1008 ¶ 103).

Patent Owner's argument, however, is premised on its proposed claim construction of the term "cover" as excluding resins and epoxies. *Id.* For reasons provided in Section II.A.1 above, we do not find that claim construction persuasive, and Patent Owner does not distinguish the prior art from claim 9 on this basis.

Thus, for the same reasons discussed above, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 9 would have been obvious over the cited combination of references. *See supra* II.E.2.i–v; Ex. 1003 ¶¶ 160–165.

4. Dependent Claims 2–6, 8, 10–16, 18, and 19

Petitioner presents undisputed contentions that claims 2–6, 8, 10–16, 18, and 19, which depend directly or indirectly from independent claim 1 or 9, are unpatentable over the combined teachings of Mendelson-1988 and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 56–63, 66–70; Ex. 1003 ¶¶ 146–157, 166–175.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1. PO Resp. 56 ("The Petition fails to establish that independent claims 1 and 9 are obvious . . . and therefore fails to establish obviousness as to any of the challenged dependent claims.").

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–6, 8, 10–16, 18, and 19 would have been obvious over the combined teachings of the cited references and as supported by the testimony of Dr. Kenny.

F. Obviousness over the Combined Teachings of Aizawa, Inokawa, and Ohsaki

Petitioner contends that claims 1–6, 8–16, 18, and 19 of the ’191 patent would have been obvious over the combined teachings of Aizawa, Inokawa, and Ohsaki. Pet. 43–46.

Because we have already determined that these claims are unpatentable based on Aizawa and Inokawa, and based on Mendelson-1988 and Inokawa, which are dispositive as to all challenged claims, we need not reach this additional ground. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App’x 984, 990 (Fed. Cir. 2020) (“[T]he Board need not address issues that are not necessary to the resolution of the proceeding.”); *see supra* §§ II.D–E.

III. CONCLUSION

In summary:[9]

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–6, 8–16, 18, 19	103	Aizawa, Inokawa	1–6, 8–16, 18, 19	
1–6, 8–16, 18, 19	103	Mendelson-1988, Inokawa	1–6, 8–16, 18, 19	
1–6, 8–16, 18, 19	103[10]	Aizawa, Inokawa, Ohsaki		
Overall Outcome			1–6, 8–16, 18, 19	

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 1–6, 8–16, 18, and 19 of the ’191 patent have been shown to be unpatentable; and

[9] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

[10] As explained above, because we conclude that the challenged claims are unpatentable on other grounds, we do not reach the merits of this ground.

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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CERTIFICATE OF SERVICE

I hereby certify that the original of this Notice of Appeal was filed via U.S.P.S. Priority Mail Express on July 27, 2022 with the Director of the United States Patent and Trademark Office at the address below:

Office of the Solicitor
United States Patent and Trademark Office
Mail Stop 8, P.O. Box 1450
Alexandria, Virginia 22313-1450

A copy of this Notice of Appeal is being filed and served on July 27, 2022 as follows:

To the USPTO Patent Trial and Appeal Board:
Patent Trial and Appeal Board
Madison Building East
600 Dulany Street
Alexandria, VA 22313

(*via PTABe2e – as authorized by the Board*)

To the U.S. Court of Appeals for the Federal Circuit:
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U.S. Court of Appeals for the Federal Circuit
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Paper 7
Entered: June 3, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00193
Patent 10,299,708 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges*.

KINDER, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–29 ("challenged claims") of U.S. Patent No. 10,299,708 B1 (Ex. 1001, "the '708 patent"). Paper 2 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a preliminary response. Paper 5 ("PO Waiver").

We have authority to determine whether to institute an *inter partes* review, under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that "the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) ("The Board institutes the trial on behalf of the Director.").

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that Petitioner would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Related Matters

The parties identify the following matters related to the '708 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1)

Apple Inc. v. Masimo Corporation, IPR2021-00195 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,190 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00208 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,258,266 B1); and

Apple Inc. v. Masimo Corporation, IPR2021-00209 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,191 B1).

Pet. 97–98; Paper 3, 3–4.

Patent Owner further identifies the following pending patent applications, among other issued and abandoned applications, that claim priority to, or share a priority claim with, the ’708 patent:

U.S. Patent Application No. 16/834,538;

U.S. Patent Application No. 17/031,407;

U.S. Patent Application No. 17/031,316;

U.S. Patent Application No. 17/031,356;

U.S. Patent Application No. 16/449,143; and

U.S. Patent Application No. 16/805,605.

Paper 3, 2–3.

C. The ’708 Patent

The ’708 patent is titled “Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents,” and issued on May 28, 2019, from U.S. Patent Application No. 16/261,366, filed Jan. 29, 2019. Ex. 1001, codes (21), (22), (45), (54). The ’708 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The ’708 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:31–33. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:22–28, 57–58. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:38–40.

Figure 1 of the ’708 patent is reproduced below.

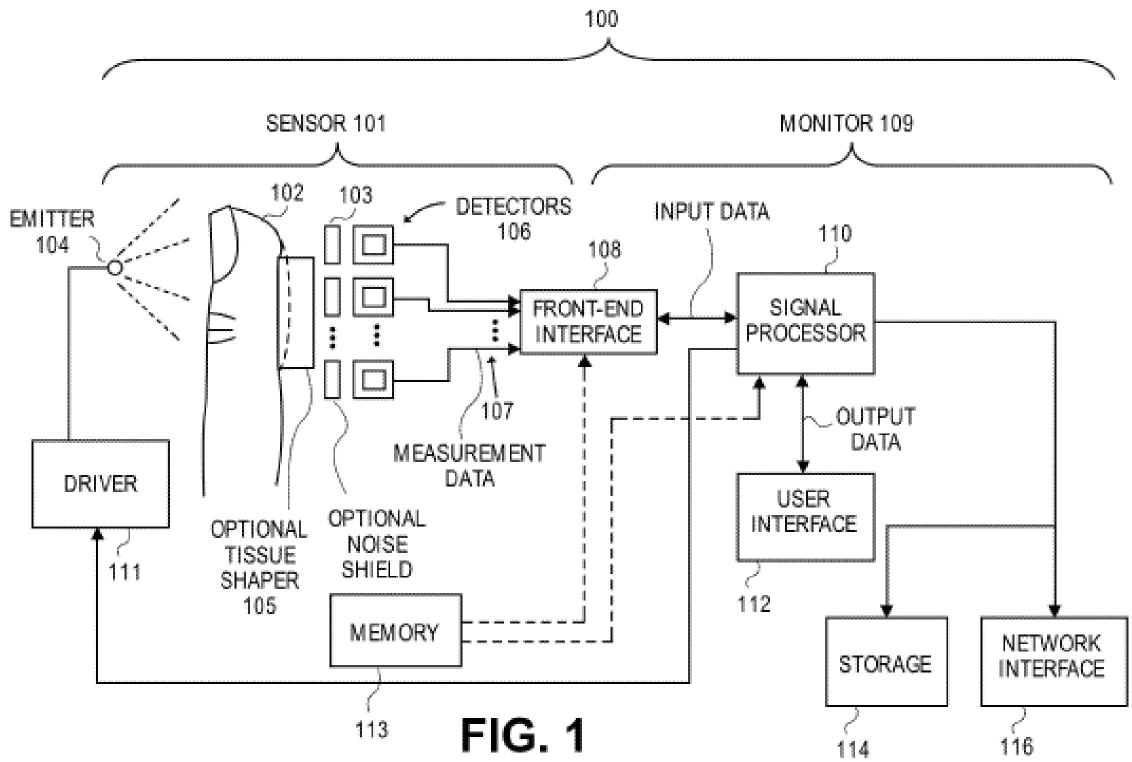


FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:36–47. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:48–52. Emitters 104 emit light that is attenuated or reflected by the patient’s tissue at measurement site 102. *Id.* at 13:60–67. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 13:64–66, 14:16–22. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient’s measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:61–11:3.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:6–8. “[S]ignal processor 110 includes processing logic that determines

measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:10–14. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:38–48. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:52–16:3.

The '708 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

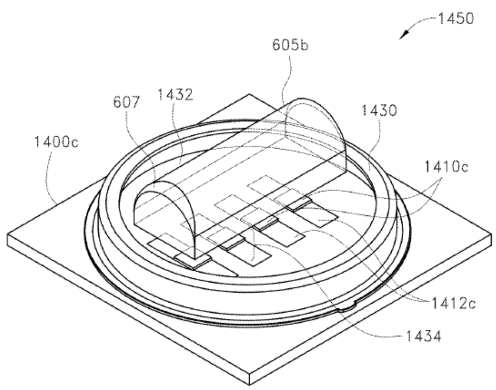


FIG. 14D

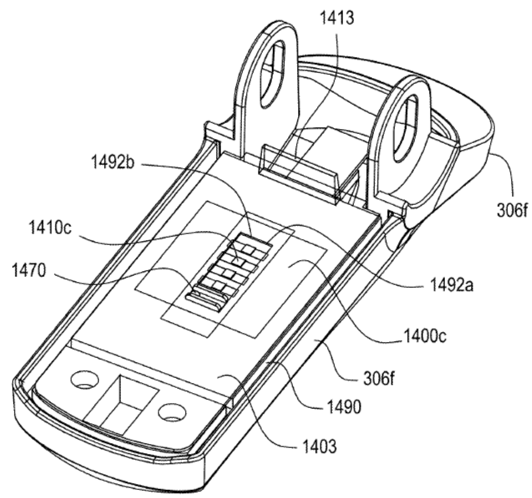


FIG. 14F

Figure 14D illustrates portions of a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:34–37. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:23–25, 36:17–24. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 36:63–37:4. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:34–36.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

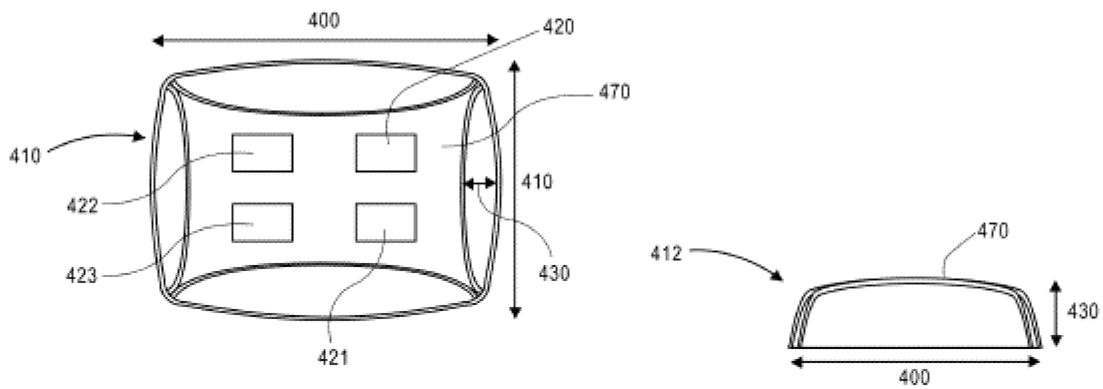


FIG. 4A FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:8–14. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:31–33. The measurement site contact area may include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:39–53.

D. Illustrative Claim

Of the challenged claims, claims 1 and 19 are independent. Claim 1 is illustrative and is reproduced below.

> 1. A noninvasive optical physiological sensing system comprising:
>
> [a] a platform including a planar surface;
>
> [b] a housing including a raised edge portion extending from and enclosing at least a portion of the planar surface;
>
> [c] at least four detectors arranged on the planar surface of the platform and within the housing, wherein the at least four

> detectors are arranged in a grid pattern such that a first detector and a second detector are arranged across from each other on opposite sides of a central point along a first axis, and a third detector and a fourth detector are arranged across from each other on opposite sides of the central point along a second axis which is perpendicular to the first axis; and
>
> [d] the housing including a protruding light permeable cover.

Ex. 1001, 44:36–50 (bracketed identifiers a–d added). Independent claim 19 includes limitations similar to limitations [a]–[d] of claim 1 but also requires distinct limitations discussed more below. *Id.* at 45:53–46:11 (reciting a "platform," "at least four detectors," and a "light permeable cover . . . protruding above the raised wall").

E. Applied References

Petitioner relies upon the following references:

> Beyer, Jr., U.S. Patent No. 7,031,728 B2, filed Sept. 21, 2004, issued Apr. 18, 2006 (Ex. 1019, "Beyer");
>
> Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");
>
> Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");
>
> Lo et al., U.S. Patent Application Publication No. 2004/0138568 A1, filed Jan. 15, 2003, published July 15, 2004 (Ex. 1028, "Lo");
>
> Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[1]

[1] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). In this Decision, we also refer to the translation.

Goldsmith et al., U.S. Patent Application Publication No. 2007/0093786 A1, filed July 31, 2006, published April 26, 2007 (Ex. 1027, "Goldsmith");

Al-Ali et al., U.S. Patent Application Publication No. 2008/0242958 A1, filed Mar. 26, 2008, published Oct. 2, 2008 (Ex. 1030, "Al-Ali");

Y. Mendelson et al., "Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Association for the Advancement of Medical Instrumentation, vol. 22, No. 4, 167–173 (1988) (Ex. 1015, "Mendelson-1988");

Y. Mendelson et al., "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Proceedings of the 28th IEEE EMBS Annual International Conference, 912–915 (2006) (Ex. 1016, "Mendelson-2006").

Pet. 3–4. Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003).

F. Asserted Grounds

Petitioner asserts that claims 1–29 are unpatentable based upon the following grounds:

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–9, 11, 13–15, 19–22, 24–27	103	Aizawa, Inokawa
1–9, 11, 13–15, 19–22, 24–27	103	Aizawa, Inokawa, Ohsaki
16, 27, 28	103	Aizawa, Inokawa, Mendelson-2006
17, 18, 29	103	Aizawa, Inokawa, Mendelson-2006, Beyer
16–18, 27–29	103	Aizawa, Inokawa, Goldsmith, Lo
10	103	Aizawa, Inokawa, Al-Ali
1–9, 11–15, 19–26	103	Mendelson-1988, Inokawa

Claim(s) Challenged	35 U.S.C. §	References/Basis
16, 27, 28	103	Mendelson-1988, Inokawa, Mendelson-2006
17, 18, 29	103	Mendelson-1988, Inokawa, Mendelson-2006, Beyer

II. DISCUSSION

A. *Claim Construction*

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 4.

Based on our analysis of the issues in dispute at this stage of the proceeding, we agree that no claim terms require express construction at this time. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. *Principles of Law*

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-

obviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 4–5 (citing Ex. 1003 ¶¶ 21–22). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

---

[2] Patent Owner does not present objective evidence of non-obviousness at this stage.

For purposes of this Decision, we generally adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa and Inokawa

Petitioner presents undisputed contentions that claims 1–9, 11, 13–15, 19–22, 24–27 of the '708 patent would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 7–40.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled "Pulse Wave Sensor and Pulse Rate Detector," and discloses a pulse wave sensor that detects light output from a light emitting diode and reflected from a patient's artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

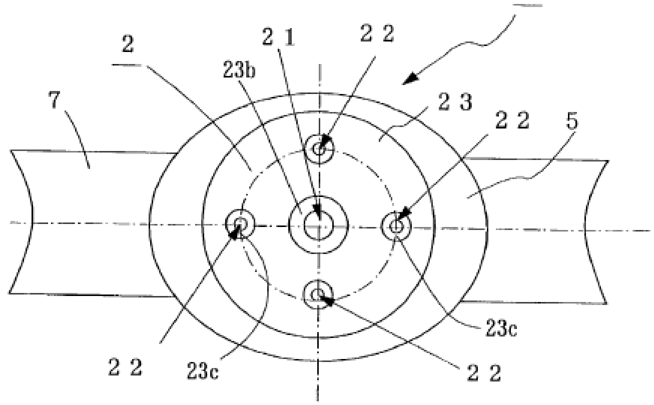


Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode ("LED") 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, "to further improve detection efficiency, . . . the number of the

photodetectors 22 may be increased." *Id.* ¶ 32, Fig. 4(a). "The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22." *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

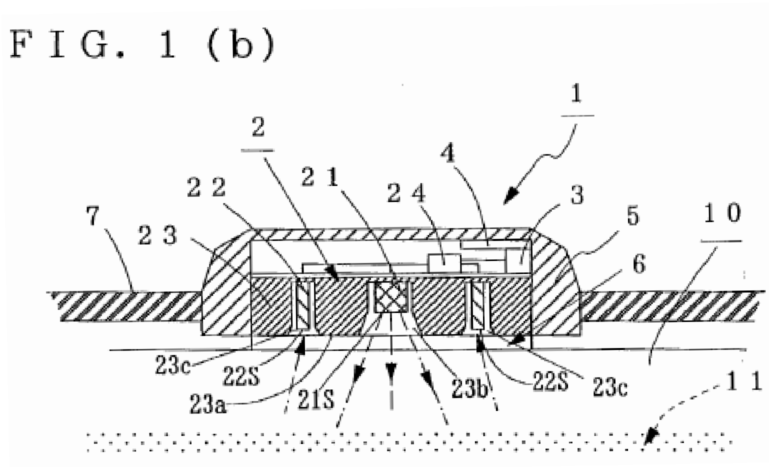


Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* ¶ 23. Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.* ¶ 23.

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* ¶ 24. Aizawa discloses that "a subject carries the above pulse rate detector 1 on

the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)." *Id.* ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. Overview of Inokawa (Ex. 1008)

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

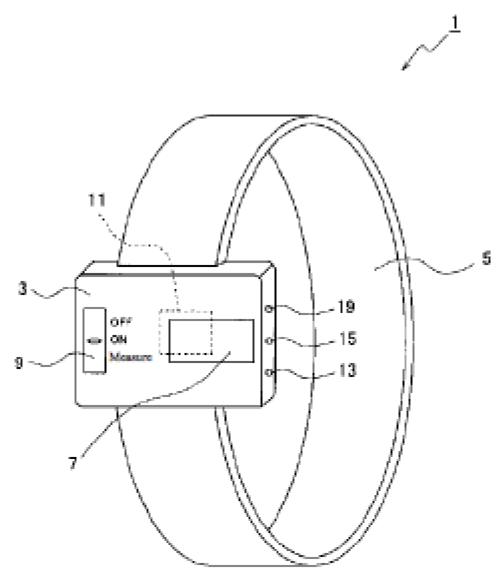


Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

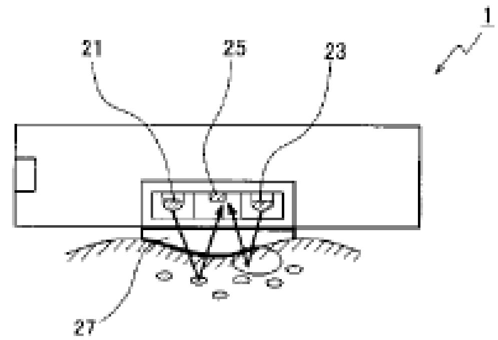


Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 senses "the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery)," and infrared LED 23 senses body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that "performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory." *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

(FIG. 3)

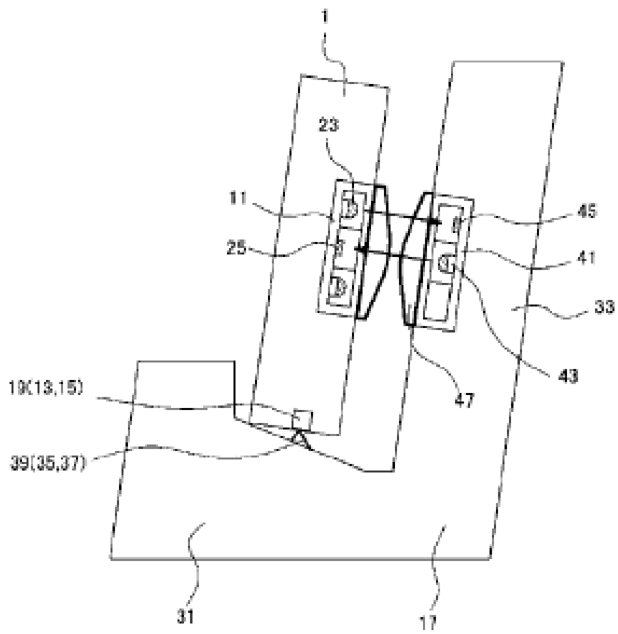


Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position, pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Independent Claim 1

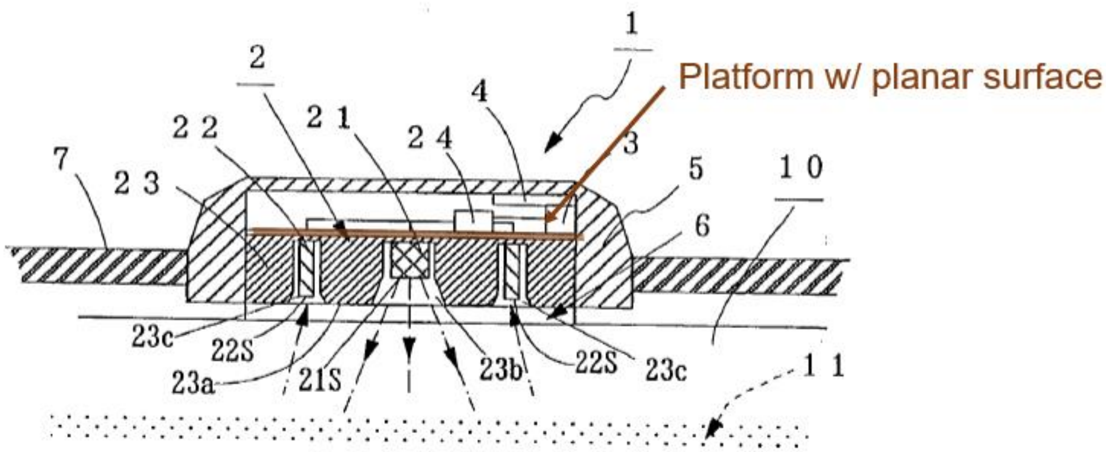
Petitioner presents undisputed contentions that claim 1 would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 12–16 (combination), 16–24 (claim 1).

i. "A noninvasive optical physiological sensing system comprising:"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses a measurement device, i.e., a pulse sensor worn on a wearer's wrist. Pet. 16; *see, e.g.*, Ex. 1006 ¶ 2 ("[A] pulse wave sensor for detecting the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist with light.").

ii. "a platform including a planar surface;"

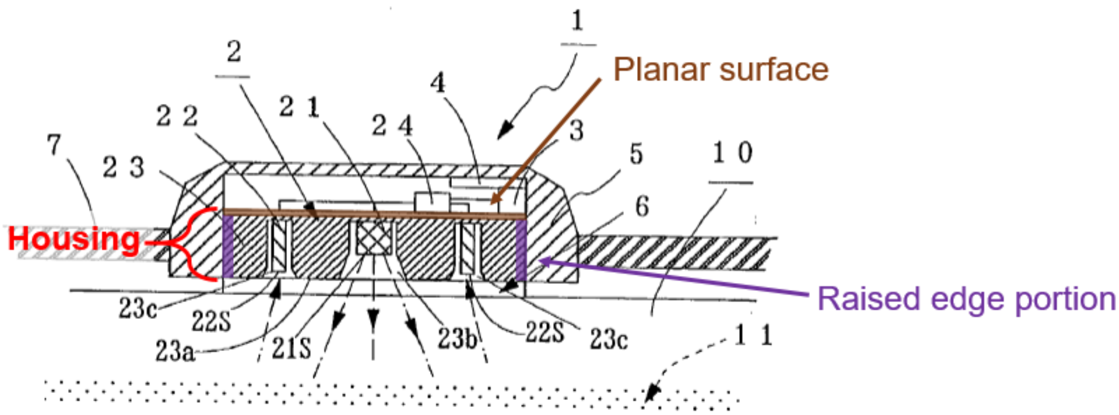
On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23 for storing light emitting diode 21 and photodetectors 22 and a platform including a planar surface on which holder 23 is placed. Pet. 17–18; *see, e.g.*, Ex. 1006 ¶¶ 23 ("LED 21 . . . for emitting light having a wavelength of a near infrared range"), Figs. 1(a)–(b). Petitioner provides the following annotated Figure 1(b) depicting the planar surface in brown.

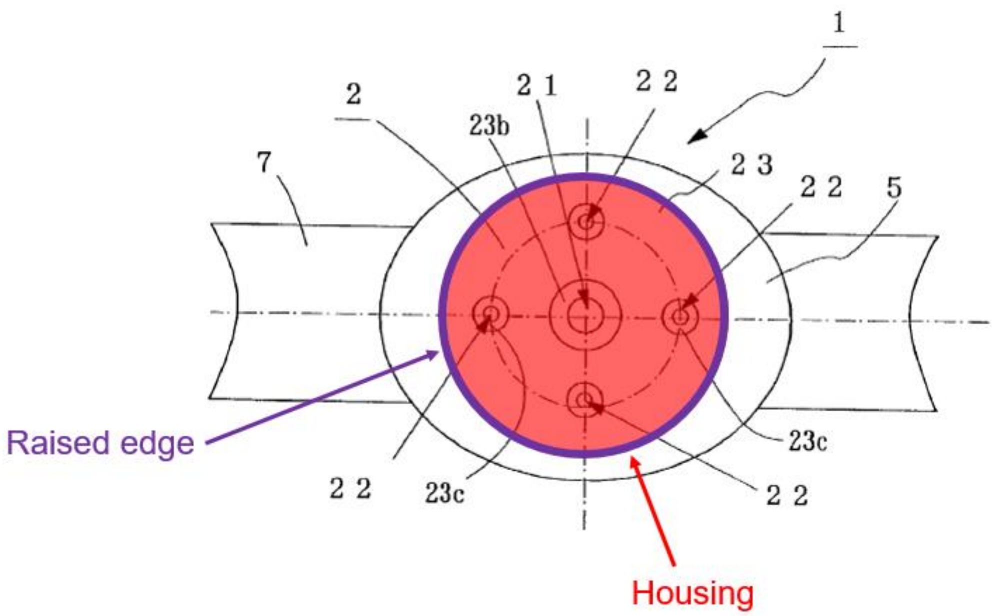


Pet. 18. Annotated Figure 1(b) depicts Aizawa's sensor with the platform with a planar surface depicted in brown. *Id.* Petitioner contends that a person of ordinary skill in the art "would have understood that the various electronic components of Aizawa, including its detectors and emitter, are positioned within the holder 23 and further connected, through the identified platform that supports the holder 23, to a drive circuit 24 on the other side of the holder/platform." *Id.* (citing Ex. 1006 ¶ 23; Ex. 1003 ¶ 75).

iii. "[b] a housing including a raised edge portion extending from and enclosing at least a portion of the planar surface"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23, which includes a flat surface and a circular raised edge extending from the surface. Pet. 19; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing . . . light emitting diode 21 and the photodetectors 22"), Figs. 1(a)–(b) (depicting holder 23 surrounding each detector 22); Ex. 1003 ¶¶ 76–77. Petitioner provides annotated versions of Aizawa's Figures 1(a) and 1(b), which are reproduced below.





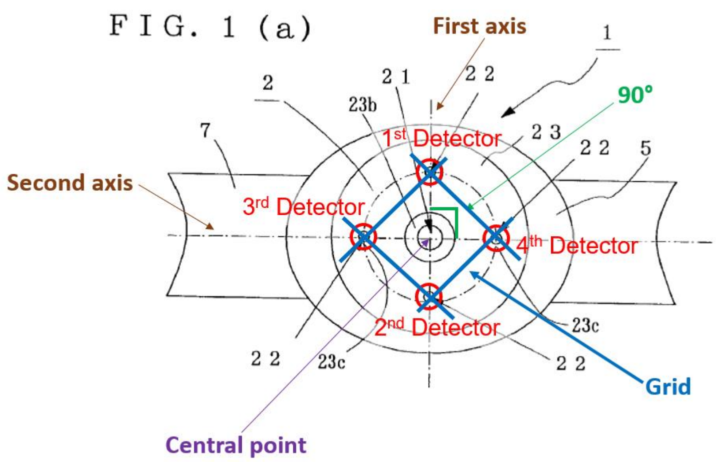
Pet. 19–20. Figures 1(a) and 1(b) depict side and top views of Aizawa's sensor with the housing depicted in red (holder 23), the raised edge depicted in purple, and the planar surface depicted in brown. *Id.*

> *iv.“[c] at least four detectors arranged on the planar surface of the platform and within the housing, wherein the at least four detectors are arranged in a grid pattern such that a first detector and a second detector are arranged across from each other on opposite sides of a central point along a first axis, and a third detector and a fourth detector are arranged across from each other on*

> *opposite sides of the central point along a second axis which is perpendicular to the first axis; and"*

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses at least four detectors 22 that are disposed around light emitting diode 21 symmetrically in a perpendicular grid pattern around light emitting diode 21. Pet. 20–21; *see, e.g.*, Ex. 1006 ¶¶ 23 ("drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of the photodetectors 22"), Fig. 1(a) (depicting detectors 22 spaced apart around LED 21 in a symmetric grid pattern), Fig. 1(b) (depicting detectors 22 connected to a drive circuit 24 on the other side of the housing), 28 ("the amplified output is converted into a digital signal for the computation of a pulse rate"); Ex. 1003 ¶¶ 78–80.

Petitioner provides annotated Figure 1(a) of Aizawa showing how the four detectors "are arranged relative to a central point and first/second axes in the manner claimed, with the first/second axes being perpendicular to each other." Pet. 22.



Pet. 22. Annotated Figure 1(a) depicts four detectors (in red) arranged in a grid pattern such that the first and second detector form a first axis that is

perpendicular to a second axis formed by the third and fourth detectors. *Id.* We find Petitioner's showing persuasive on the current record.

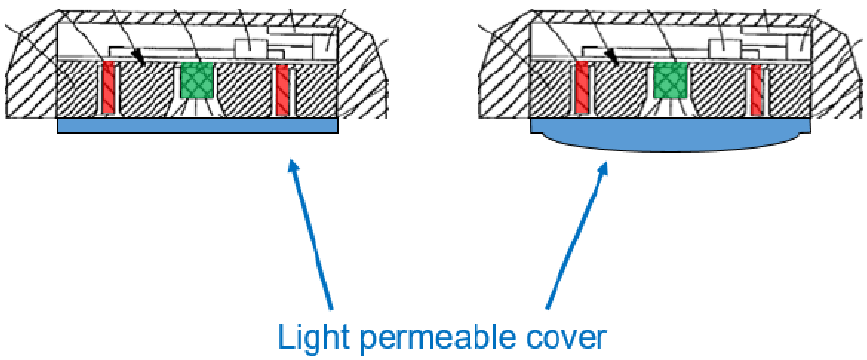
v. "[d] the housing including a protruding light permeable cover."

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 12–16, 22–24. Specifically, Petitioner contends that Aizawa discloses a protruding cover in the form of an "acrylic transparent plate" mounted over at least a portion of the housing and to cover the at least four detectors. *Id.* at 22; Ex. 1006 ¶¶ 23, 34 ("[A]crylic transparent plate 6 is provided on the detection face 23a of the holder 23 to improve adhesion to the wrist 10."), Fig. 1(b) (depicting flat, transparent plate 6 between sensor 2 and wrist 10); Ex. 1003 ¶ 83 ("Because the light permeable cover of Aizawa . . . protrudes from the rest of the housing and is designed to be pressed into the skin when worn, it is protruding—and is thus a protruding light permeable cover.").

Petitioner further contends that Inokawa also teaches a protruding light permeable cover and provides motivation for incorporating such a cover into Aizawa. Pet. 13, 23. Specifically, Inokawa's lens 27 is positioned between its sensor and the wearer's skin, which increases the light gathering ability of the sensor. *Id.* at 13, 23; *see, e.g.*, Ex. 1008 ¶¶ 15 ("This lens makes it possible to increase the light-gathering ability of the LED as well as to protect the LED or PD."), 58 (disclosing "a single photodiode (S-side PD) 25 that receives the reflected light from these [LEDs], and an S-side lens 27"), Fig. 2.

In light of these teachings, Petitioner contends that a person of ordinary skill in the art "would have found it obvious to modify the flat

acrylic plate of Aizawa, as illustrated below, to further Aizawa's objective of enhancing light-collection efficiency," i.e., "by modifying the light permeable cover of Aizawa to include a convex protrusion that acts as a lens." Pet. 13, 23–24.



Pet. 14–15, 23–24; Ex. 1006 ¶¶ 13 (explaining that transparent plate 6 seeks to "improve adhesion" and "improve the detection efficiency of pulse waves"), 30 (same); Ex. 1008 ¶ 15; Ex. 1003 ¶¶ 82–87. Petitioner's annotated and modified Figures depict Aizawa's sensor including its flat transparent plate (left) and a modified version of Aizawa's sensor in which the plate includes a convex protrusion. Pet. 14, 24.

Petitioner contends this modification would have enjoyed a reasonable expectation of success because, for example, Inokawa teaches that the cover may be flat, like that of Aizawa, to reduce scratches, or in the form of a lens, as in Petitioner's proposed modification, to increase light gathering ability. *Id.* at 14–16; *see, e.g.*, Ex. 1008 ¶¶ 15 ("This lens makes it possible to increase the light-gathering ability."), 106 ("[B]ecause the surface of the covers 123, 131 is flat, the surface is less prone to scratches than when the lens protrudes."); Ex. 1003 ¶ 88.

At this stage of the proceeding, Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 83–88.

vi. Summary

For the foregoing reasons, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

4. *Independent Claim 19*

Independent claim 19 consists of certain limitations that are similar to elements [a]–[d] of claim 1, but claim 19 also has distinct claim language. *Compare* Ex. 1001, 44:36–50, *with id.* at 45:53–46:11. In asserting that claim 19 also would have been obvious over the combined teachings of Aizawa and Inokawa, Petitioner refers to similar arguments presented as to claim 1. *See* Pet. 35–38; Ex. 1003 ¶¶ 110–115. We address the differences in claim scope, and Petitioner's arguments, below.

Similar to claim 1, claim 19 requires a platform and a housing, but uniquely the claim further requires the "platform forming a base of a housing, the housing including a raised wall protruding from the platform." Ex. 1001, 45:55–56. Dr. Kenny explains how Aizawa teaches these unique "base of a housing" limitations of claim 19. *See* Ex. 1003 ¶¶ 111–112 (Aizawa's "holder and the platform together provide the housing in the manner claimed" and "the housing includes a raised wall . . . that protrudes from the platform."). Thus, Petitioner shows how Aizawa teaches these limitations. Pet. 35–36.

Claim 19 similarly requires "at least four detectors" but instead of a having a "grid pattern" limitation (as with claim 1), claim 19 uniquely requires that the four detectors are spaced apart and "configured to output one or more signals responsive to light from one or more light emitters attenuated by body tissue, the one or more signals indicative of a physiological parameter of a wearer of the noninvasive optical physiological sensing system." Ex. 1001, 46:3–8. Petitioner explains persuasively how Aizawa's detectors detect light reflected by a red corpuscle running through an artery of the wrist, such that a pulse wave is detected. Pet. 36–37 (citing Ex. 1006 ¶ 27). For example, Aizawa's detectors output "waveform of a pulse wave," and the output can be amplified and "converted into a digital signal for the computation of a pulse rate." Ex. 1006 ¶ 28. "Thus," according to Petitioner, "the detectors of Aizawa 'output one or more signals responsive to light from the one or more light emitters attenuated by body tissue.'" Pet. 37 (quoting Ex. 1003 ¶ 114).

The remaining limitations of claim 19 are substantially the same as claim 1 discussed above. Considering the record before us, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 19.

5. Dependent Claims 2–9, 11, 13–15, 20–22, and 24–27

Petitioner presents undisputed contentions that claims 2–9, 11, 13–15, 20–22, and 24–27, which depend directly or indirectly from independent claim 1 or 19, are unpatentable over the combined teachings of Aizawa and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 24–35, 38–40; Ex. 1003 ¶¶ 90–109, 116–

122. Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. PO Waiver. We have reviewed these arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions.

Moreover, as discussed in detail above, Petitioner has demonstrated a reasonable likelihood of prevailing on the challenge to claims 1 and 19. Therefore, pursuant to USPTO policy implementing the decision in *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348 (2018) ("*SAS*"), we institute as to all claims challenged in the petition and on all grounds in the petition. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated Guide")[3], 5–6, 64.

E. Other Grounds

Petitioner provides arguments and evidence, including the Kenny Declaration, in support of Petitioner's various other grounds challenging claims 1–29 of the '708 patent. Pet. 40–96; Ex. 1003 ¶¶ 123–227. Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. PO Waiver. We have reviewed these arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions. We institute review of all of these challenges. *See SAS*, 138 S. Ct. 1348; Consolidated Practice Guide, 5–6, 64.

[3] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

III. CONCLUSION

The Supreme Court held that a final written decision under 35 U.S.C. § 318(a) must decide the patentability of all claims challenged in the petition. *SAS*, 138 S. Ct. 1348. After considering the evidence and arguments presented in the Petition, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least claims 1 and 19 of the ’708 patent are unpatentable. Accordingly, we institute an *inter partes* review of all claims and all grounds set forth in the Petition.

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–29 of the ’708 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the ’708 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

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Paper 7
Date: June 3, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00195
Patent 10,376,190 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges.*

WIEKER, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–14 and 16–30 ("challenged claims") of U.S. Patent No. 10,376,190 B1 (Ex. 1001, "the '190 patent"). Paper 2 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a preliminary response. Paper 6 ("PO Waiver").

We have authority to determine whether to institute an *inter partes* review, under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that "the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) ("The Board institutes the trial on behalf of the Director.").

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that Petitioner would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Related Matters

The parties identify the following matters related to the '190 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1)

Apple Inc. v. Masimo Corporation, IPR2021-00193 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,299,708 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00208 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,258,266 B1); and

Apple Inc. v. Masimo Corporation, IPR2021-00209 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,191 B1).

Pet. 100; Paper 3, 3–4.

Patent Owner further identifies the following pending patent applications, among other issued and abandoned applications, that claim priority to, or share a priority claim with, the '190 patent:

U.S. Patent Application No. 16/834,538;

U.S. Patent Application No. 17/031,407;

U.S. Patent Application No. 17/031,316;

U.S. Patent Application No. 17/031,356;

U.S. Patent Application No. 16/449,143; and

U.S. Patent Application No. 16/805,605.

Paper 3, 1–3.

C. The '190 Patent

The '190 patent is titled "Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents," and issued on August 13, 2019, from U.S. Patent Application No. 16/409,304, filed May 10, 2019. Ex. 1001, codes (21), (22), (45), (54). The '190 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The '190 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:31–33. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:22–28, 57–58. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:38–40.

Figure 1 of the '190 patent is reproduced below.

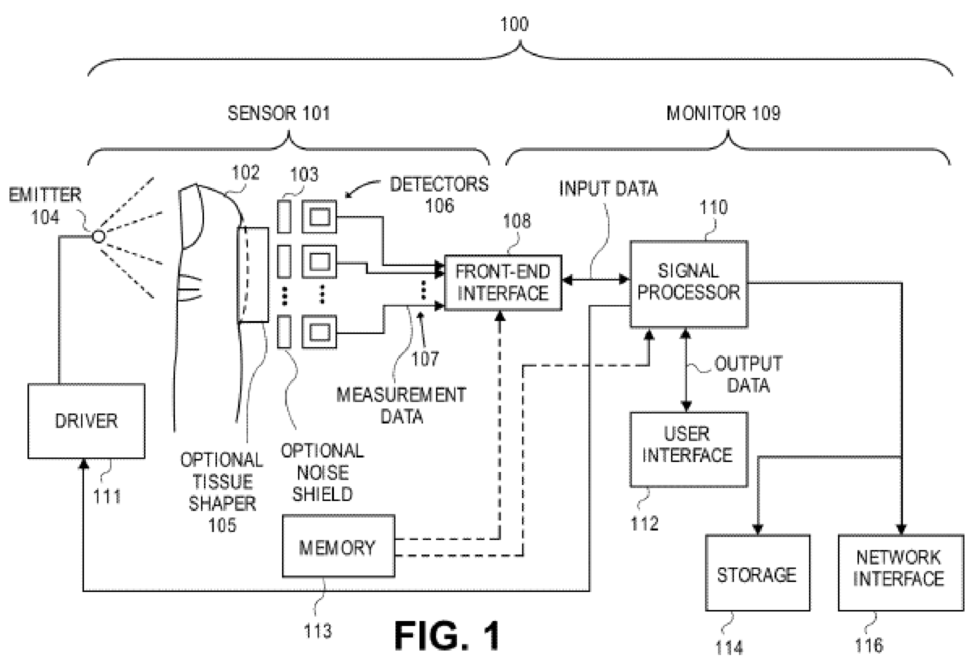

FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:36–47. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:48–52. Emitters 104 emit light that is attenuated or reflected by the patient's tissue at measurement site 102. *Id.* at 13:60–67. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 13:64–66, 14:16–22. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:61–11:3.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:6–8. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:10–14. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:38–48. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:52–16:3.

The '190 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

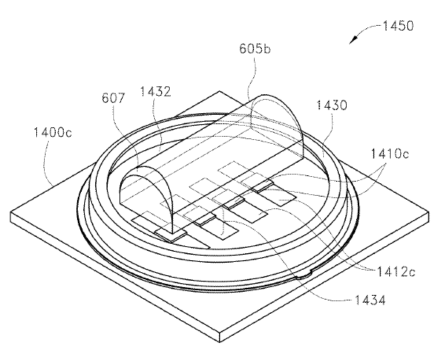

FIG. 14D

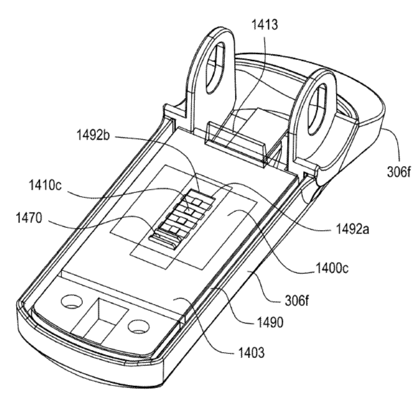

FIG. 14F

Figure 14D illustrates portions of a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:34–37. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:23–25, 36:17–24. Figure 14F illustrates detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 36:63–37:4. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:34–36.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

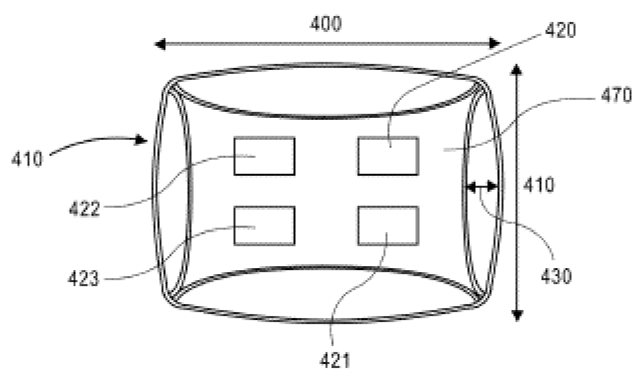

FIG. 4A

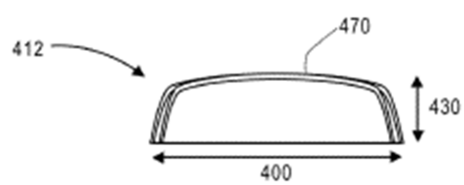

FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:8–14. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:31–33. The measurement site contact area may include windows 420–

423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:39–53.

D. Illustrative Claim

Of the challenged claims, claims 1 and 26 are independent. Claim 1 is illustrative and is reproduced below.

> 1. A noninvasive optical physiological measurement device adapted to be worn by a wearer, the noninvasive optical physiological measurement device providing an indication of a physiological parameter of the wearer comprising:
>
> [a] one or more light emitters;
>
> [b] a housing having a surface and a circular raised edge extending from the surface;
>
> [c] at least four detectors arranged on the surface and spaced apart from each other, the at least four detectors configured to output one or more signals responsive to light from the one or more light emitters attenuated by body tissue, the one or more signals indicative of a physiological parameter of the wearer; and
>
> [d] a light permeable cover arranged above at least a portion of the housing, the light permeable cover comprising a protrusion arranged to cover the at least four detectors.

Ex. 1001, 44:37–53 (bracketed identifiers a–d added). Independent claim 26 includes limitations substantially similar to limitations [a]–[d] of claim 1. *Id.* at 46:22–40 (reciting a "wall" and a "lens portion").

E. Applied References

Petitioner relies upon the following references:

Beyer, Jr., U.S. Patent No. 7,031,728 B2, filed Sept. 21, 2004, issued Apr. 18, 2006 (Ex. 1019, "Beyer");

Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");

Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");

Lo et al., U.S. Patent Application Publication No. 2004/0138568 A1, filed Jan. 15, 2003, published July 15, 2004 (Ex. 1028, "Lo");

Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[1]

Goldsmith et al., U.S. Patent Application Publication No. 2007/0093786 A1, filed July 31, 2006, published April 26, 2007 (Ex. 1027, "Goldsmith");

Al-Ali et al., U.S. Patent Application Publication No. 2008/0242958 A1, filed Mar. 26, 2008, published Oct. 2, 2008 (Ex. 1030, "Al-Ali");

Y. Mendelson et al., "Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Association for the Advancement of Medical Instrumentation, vol. 22, No. 4, 167–173 (1988) (Ex. 1015, "Mendelson-1988"); and

Y. Mendelson et al., "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Proceedings of the 28th IEEE EMBS Annual International Conference, 912–915 (2006) (Ex. 1016, "Mendelson-2006").

Pet. 4. Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003).

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[1] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). In this Decision, we also refer to the translation.

F. Asserted Grounds

Petitioner asserts that claims 1–14 and 16–30 are unpatentable based upon the following grounds:

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–14, 16, 17, 19–23, 26–29	103	Aizawa, Inokawa
1–14, 16, 17, 19–23, 26–29	103	Aizawa, Inokawa, Ohsaki
23, 24	103	Aizawa, Inokawa, Mendelson-2006
23–25	103	Aizawa, Inokawa, Goldsmith, Lo
25	103	Aizawa, Inokawa, Mendelson-2006, Beyer
5	103	Aizawa, Inokawa, Al-Ali
1–14, 16–22, 26–30	103	Mendelson-1988, Inokawa, Mendelson-2006
25	103	Mendelson-1988, Inokawa, Mendelson-2006, Beyer

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 4–5.

Based on our analysis of the issues in dispute at this stage of the proceeding, we agree that no claim terms require express construction at this time. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-obviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

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[2] Patent Owner does not present objective evidence of non-obviousness at this stage.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 5 (citing Ex. 1003 ¶¶ 21–22). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

For purposes of this Decision, we generally adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa and Inokawa

Petitioner presents undisputed contentions that claims 1–14, 16, 17, 19–23, and 26–29 of the '190 patent would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 8–42.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled "Pulse Wave Sensor and Pulse Rate Detector," and discloses a pulse wave sensor that detects light output from a light emitting diode and reflected from a patient's artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

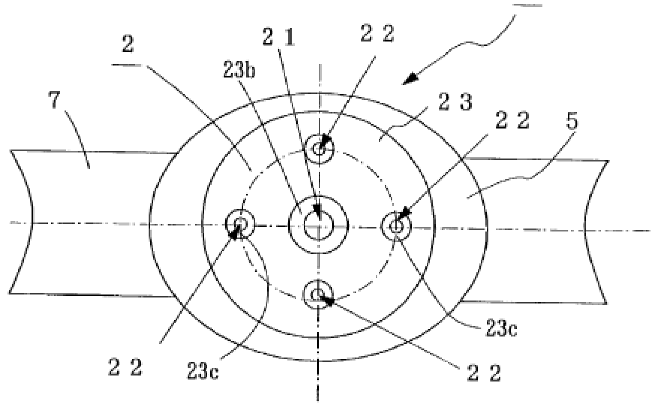


Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode ("LED") 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, "to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased." *Id.* ¶ 32, Fig. 4(a). "The same effect can be obtained when the number of photodetectors 22 is [one] and a plurality of light emitting diodes 21 are disposed around the photodetector 22." *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

FIG. 1 (b)

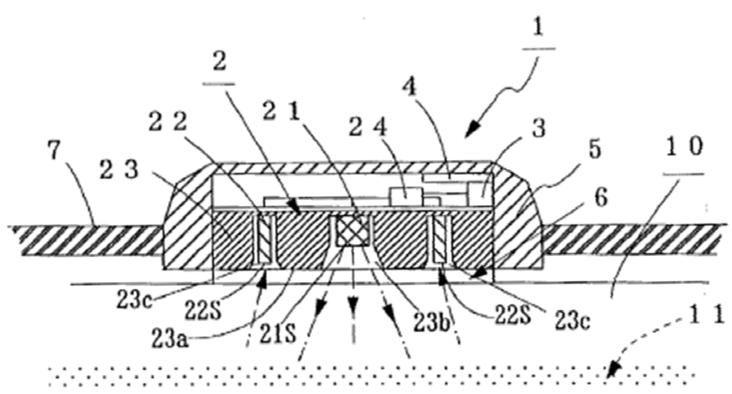


Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* ¶ 23. Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.* ¶ 23.

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* ¶ 24. Aizawa discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)." *Id.* ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. *Overview of Inokawa (Ex. 1008)*

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

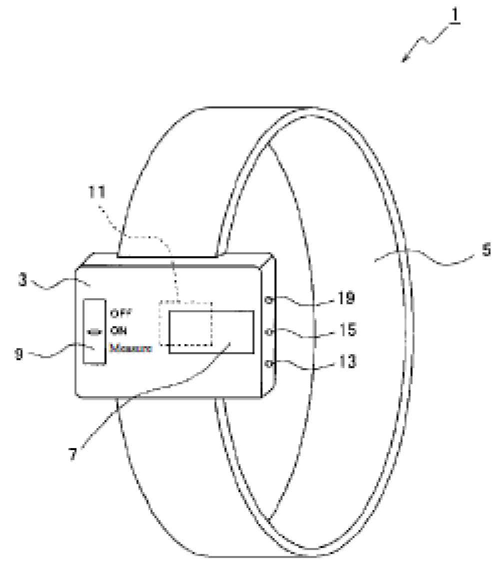


Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

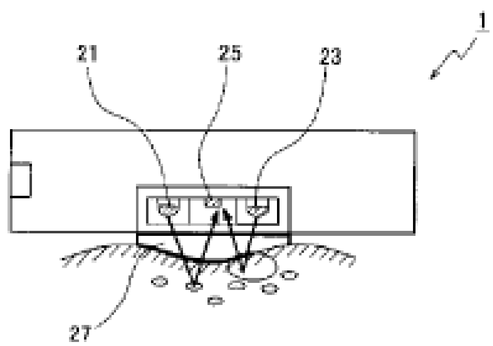


Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as

photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 senses "the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery)," and infrared LED 23 senses body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that "performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory." *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

(FIG. 3)

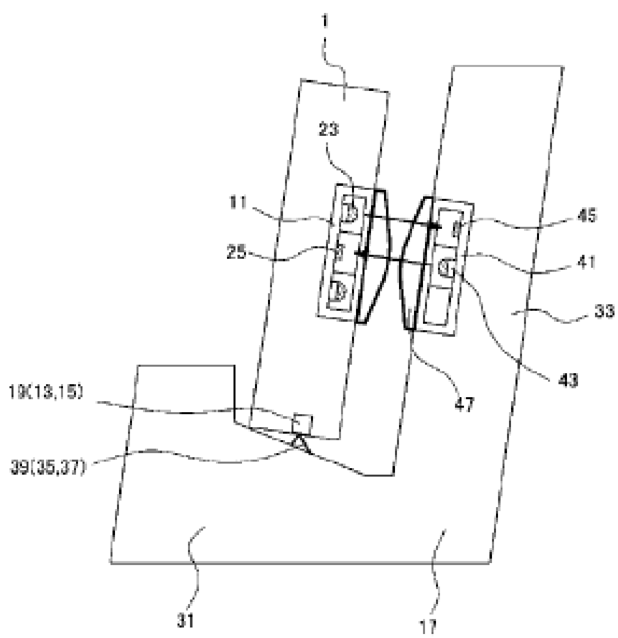


Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position,

pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Independent Claim 1

Petitioner presents undisputed contentions that claim 1 would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 13–17 (combination), 17–23 (claim 1).

i. "A noninvasive optical physiological measurement device adapted to be worn by a wearer, the noninvasive optical physiological measurement device providing an indication of a physiological parameter of the wearer comprising"

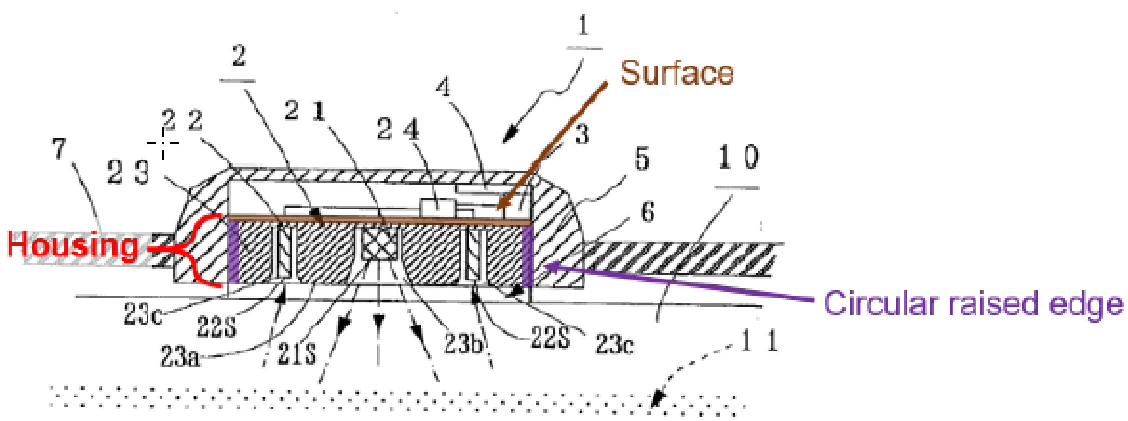
On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses a measurement device, i.e., a pulse sensor worn on a wearer's wrist. Pet. 17; *see, e.g.*, Ex. 1006 ¶ 2 ("[A] pulse wave sensor for detecting the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist with light.").

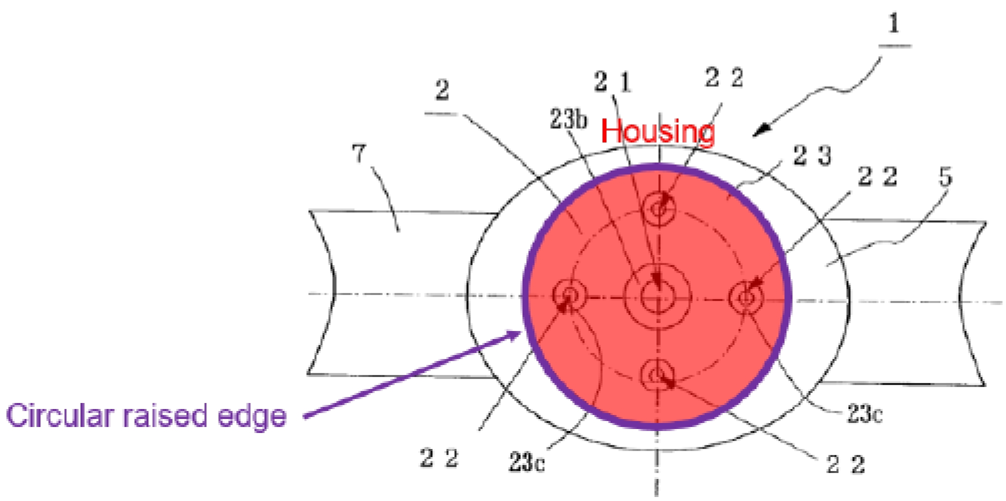
ii. "[a] one or more light emitters"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses LED 21 that emits light. Pet. 17–18; *see, e.g.*, Ex. 1006 ¶¶ 23 ("LED 21 . . . for emitting light having a wavelength of a near infrared range"), Figs. 1(a)–(b).

iii. "[b] a housing having a surface and a circular raised edge extending from the surface"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23, which includes a flat surface and a circular raised edge extending from the surface. Pet. 18–19; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing . . . light emitting diode 21 and the photodetectors 22"), Figs. 1(a)–(b) (depicting holder 23 surrounding each detector 22); Ex. 1003 ¶¶ 75–76. Petitioner provides annotated versions of Aizawa's Figures 1(a) and 1(b), which are reproduced below.





Pet. 18–19. Figures 1(a) and 1(b) depict side and top views of Aizawa's sensor with the housing depicted in red (holder 23), the circular raised edge depicted in purple, and the surface depicted in brown. *Id.*

iv. "[c] at least four detectors arranged on the surface and spaced apart from each other, the at least four detectors configured to output one or more signals responsive to light from the one or more light emitters attenuated by body tissue, the one or more signals indicative of a physiological parameter of the wearer"

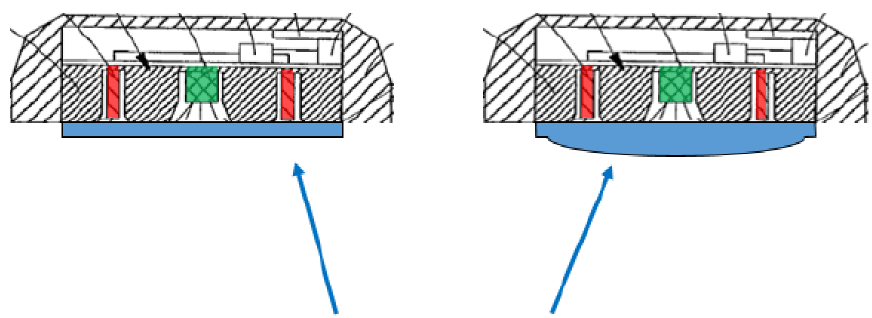
On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses at least four detectors 22 that are spaced apart on the device's surface, wherein each detector outputs a signal indicative of a physiological parameter in response to light emitted by LED 21 that is attenuated by body tissue. Pet. 19–21; *see, e.g.*, Ex. 1006 ¶ 23 ("drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of the photodetectors 22"), Fig. 1(a) (depicting detectors 22 spaced apart around LED 21), ¶ 28 ("[T]he amplified output is converted into a digital signal for the computation of a pulse rate."); Ex. 1003 ¶¶ 77–79.

v. "[d] a light permeable cover arranged above at least a portion of the housing, the light permeable cover comprising a protrusion arranged to cover the at least four detectors."

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 13–16, 22–23. Specifically, Petitioner contends that Aizawa discloses a cover in the form of an "acrylic transparent plate" mounted over at least a portion of the housing and covering the at least four photodetectors. *Id.* at 22; Ex. 1006 ¶¶ 23, 34 ("[A]crylic transparent plate 6 is provided on the detection face 23a of the holder 23 to improve adhesion to the wrist 10."), Fig. 1(b) (depicting flat, transparent plate 6 between sensor 2 and wrist 10). Petitioner contends that

although Aizawa does not disclose a "protrusion" on the cover, Inokawa teaches lens 27 positioned between its sensor and the wearer's skin, which increases the light gathering ability of the sensor. *Id.* at 13, 22; *see, e.g.*, Ex. 1008 ¶¶ 15 ("This lens makes it possible to increase the light-gathering ability of the LED as well as to protect the LED or PD."), 58 (disclosing "a single photodiode (S-side PD) 25 that receives the reflected light from these [LEDs], and an S-side lens 27"), Fig. 2.

In light of these teachings, Petitioner contends that a person of ordinary skill in the art "would have found it obvious to modify the flat acrylic plate of Aizawa . . . to further Aizawa's objective of enhancing light-collection efficiency," i.e., "by modifying the light permeable cover of Aizawa to include a convex protrusion that acts as a lens," as illustrated below.



Pet. 14–15, 22–23; Ex. 1006 ¶¶ 13 (explaining that transparent plate 6 seeks to "improve adhesion" and "improve the detection efficiency of pulse waves"), 30 (same); Ex. 1008 ¶ 15; Ex. 1003 ¶¶ 82–87. Petitioner's annotated and modified Figures depict Aizawa's sensor including its flat transparent plate (left) and a modified version of Aizawa's sensor in which the plate includes a convex protrusion. Pet. 15, 23.

Petitioner contends this modification would have enjoyed a reasonable expectation of success because, for example, Inokawa teaches that the cover may be flat, like that of Aizawa, to reduce scratches, or in the form of a lens, as in Petitioner's proposed modification, to increase light gathering ability. *Id.* at 15–16; *see, e.g.*, Ex. 1008 ¶¶ 15 ("This lens makes it possible to increase the light-gathering ability."), 106 ("[B]ecause the surface of the covers 123, 131 is flat, the surface is less prone to scratches than when the lens protrudes."); Ex. 1003 ¶ 87. Petitioner also contends that a person of ordinary skill in the art "would have found it obvious make the protruded lens portion sufficiently large to ensure that the above-noted light concentration effect is felt by all of the detectors." Pet. 23; *see, e.g.*, Ex. 1003 ¶ 85.

At this stage of the proceeding, Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 82–87.

vi. Summary

For the foregoing reasons, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

4. *Independent Claim 26*

Independent claim 26 consists of limitations that are substantially similar to elements [a]–[d] of claim 1. *Compare* Ex. 1001, 44:37–53, *with id.* at 46:22–40 (reciting a "wall" and a "lens portion"). In asserting that claim 26 also would have been obvious over the combined teachings of Aizawa and Inokawa, Petitioner refers to substantially the same arguments

presented as to claim 1. *See* Pet. 39–41; Ex. 1003 ¶¶ 119–124. For the same reasons discussed above, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 21. *See supra* II.D.3.i–v.

5. Dependent Claims 2–14, 16–25, and 27–30

Petitioner presents undisputed contentions that claims 2–14, 16–25, and 27–30, which depend directly or indirectly from independent claim 1 or 26, are unpatentable over the combined teachings of Aizawa and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 23–39, 41–42; Ex. 1003 ¶¶ 88–118, 125–127. Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. PO Waiver. We have reviewed these arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions.

Moreover, as discussed in detail above, Petitioner has demonstrated a reasonable likelihood of prevailing on the challenge to claims 1 and 26. Therefore, pursuant to USPTO policy implementing the decision in *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348 (2018) ("*SAS*"), we institute as to all claims challenged in the petition and on all grounds in the petition. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated Guide")[3], 5–6, 64.

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[3] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

E. Other Grounds

Petitioner provides arguments and evidence, including the Kenny Declaration, in support of Petitioner's various other grounds challenging claims 1–14 and 16–30 of the '190 patent. Pet. 42–99; Ex. 1003 ¶¶ 128–231. Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. PO Waiver. We have reviewed these arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions. We institute review of all of these challenges. *See SAS*, 138 S. Ct. 1348; Consolidated Practice Guide, 5–6, 64.

III. CONCLUSION

The Supreme Court held that a final written decision under 35 U.S.C. § 318(a) must decide the patentability of all claims challenged in the petition. *SAS*, 138 S. Ct. 1348. After considering the evidence and arguments presented in the Petition, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least claims 1 and 26 of the '190 patent are unpatentable. Accordingly, we institute an *inter partes* review of all claims and all grounds set forth in the Petition.

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–14 and 16–30 of the ’190 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the ’190 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

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Paper 7
Entered: June 3, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00208
Patent 10,258,266 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges*.

KINDER, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–6, 8–16, 18, and 19 ("challenged claims") of U.S. Patent No. 10,258,266 B1 (Ex. 1001, "the '266 patent"). Paper 2 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a preliminary response. Paper 5 ("PO Waiver").

We have authority to determine whether to institute an *inter partes* review, under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that "the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) (2020) ("The Board institutes the trial on behalf of the Director.").

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that Petitioner would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Related Matters

The parties identify the following matters related to the '266 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00193 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,299,708 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00195 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,190 B1); and

Apple Inc. v. Masimo Corporation, IPR2021-00209 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,191 B1).

Pet. 1, 72–73;[1] Paper 3, at 1, 3–4.

Patent Owner further identifies certain issued patent applications, as well as other pending and abandoned applications, that claim priority to, or share a priority claim with, the ’266 patent. Paper 3, at 1–3.

C. The ’266 Patent

The ’266 patent is titled “Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents,” and issued on April 16,

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[1] Petitioner lists “U.S. Patent[] 10,299,708 (IPR2020-00193)” as a related *inter partes* review petition. Pet. 73. The case number associated with Patent No. 10,299,708 B1 is IPR2021-00193 and not “IPR2020-00193” as listed by Petitioner.

Case: 22-2069 Document: 21 Page: 390 Filed: 05/11/2023

2019, from U.S. Patent Application No. 16/212,537, filed December 6, 2018. Ex. 1001, codes (21), (22), (45), (54). The ’266 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/086,060, 61/086,108, 61/086,063, and 61/086,057, each filed on August 4, 2008, as well as 61/091,732 filed on August 25, 2008, and 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The ’266 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:31–33. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:22–28, 55–58. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:35–41.

Figure 1 of the ’266 patent is reproduced below.

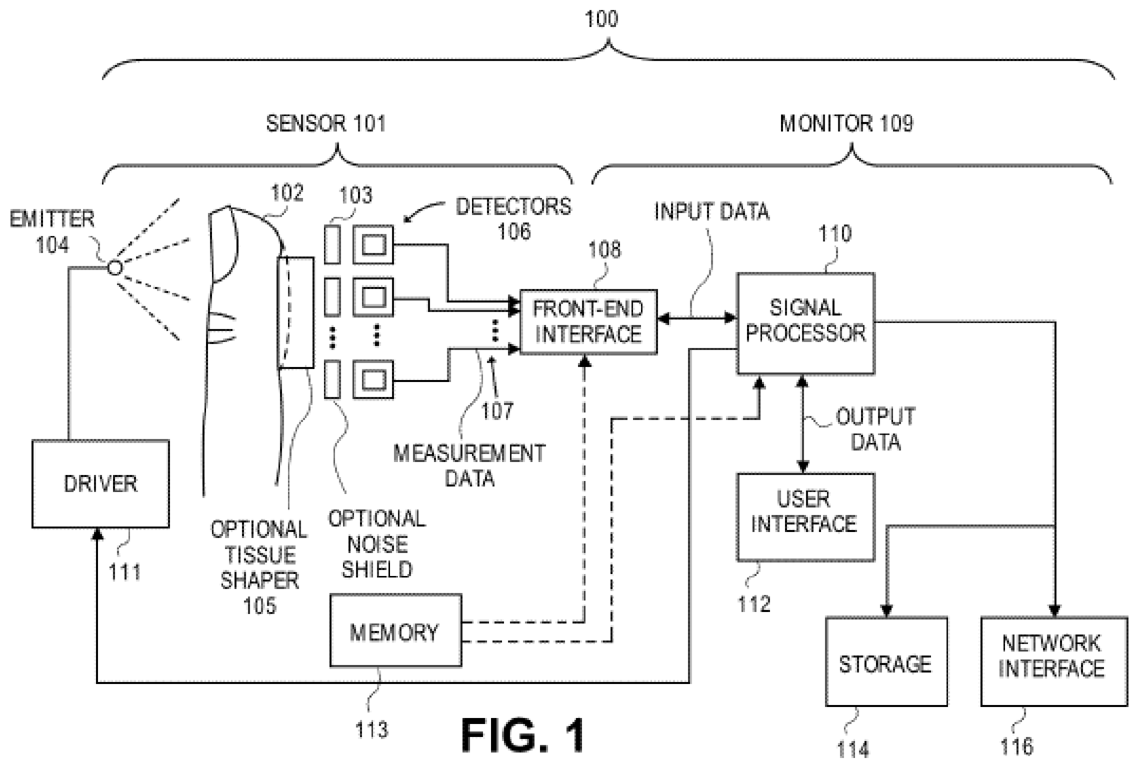

FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:36–38. Sensor 101 includes emitter 104 and detectors 106. *Id.* at 11:48–50. Emitter 104 emits light that is attenuated or reflected by the patient’s tissue at measurement site 102. *Id.* at 13:61–64. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signal 107 to monitor 109 through front-end interface 108. *Id.* at 14:16–22. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient’s measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:59–11:3.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:6–8. “[S]ignal processor 110 includes processing logic that determines

measurements for desired analytes . . . based on the signals received from the detectors 106." *Id.* at 15:12–15. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:38–42. In response to user input or device orientation, user interface 112 can "reorient its display indicia." *Id.* at 15:44–48. The monitor may include storage device 114 and network interface 116. *Id.* at 15:52–54. In some embodiments, the monitor, including the display, is attached to the patient by a strap. *Id.* at 17:64–67.

The '266 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

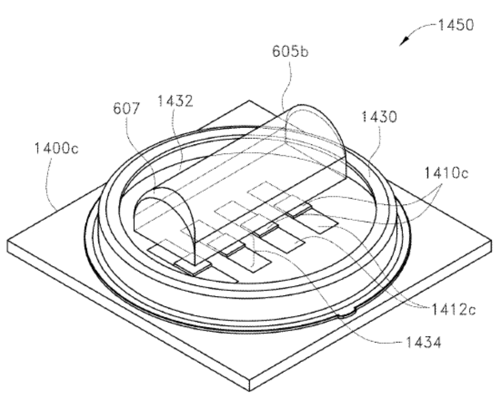

FIG. 14D

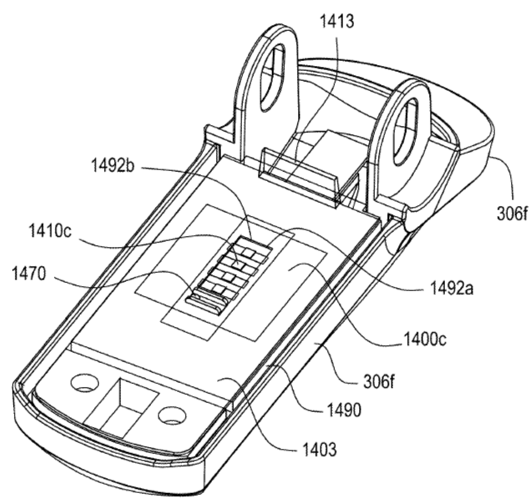

FIG. 14F

Figure 14D illustrates a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:34–37. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b is disposed. *Id.* at 36:17–24. Figure 14F illustrates detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 36:63–64. In some embodiments, the detector shell includes walls to separate individual photodiode arrays and to "prevent or

reduce mixing of light signals." *Id.* at 22:28–31. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* at 36:65–37:8.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

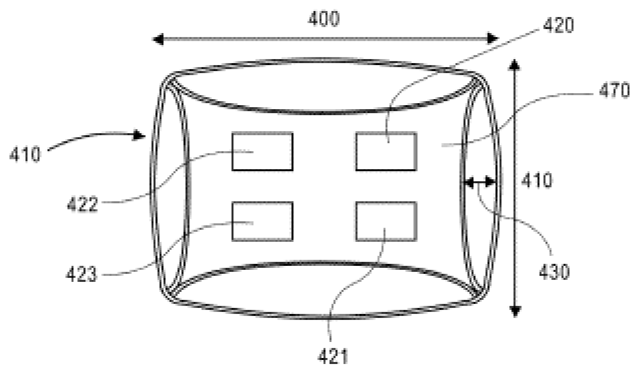

FIG. 4A

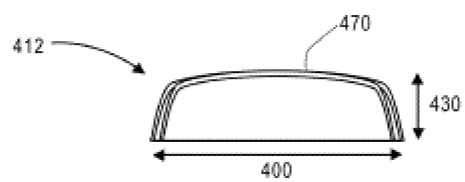

FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement site contact area 470. *Id.* at 23:8–14. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, the measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:31–33. The measurement site contact area includes windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:39–53.

D. Illustrative Claim

Of the challenged claims, claims 1 and 9 are independent. Claim 1 is illustrative and is reproduced below.

1. A noninvasive optical physiological sensor comprising:

[a] a plurality of emitters configured to emit light into tissue of a user;

[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors;

[c] a housing configured to house at least the plurality of detectors; and

[d] a lens configured to be located between the tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor worn by the user and during operation of the noninvasive optical physiological sensor.

Ex. 1001, 44:36–54 (bracketed lettering [a]–[d] added). Independent claim 9 includes limitations similar to limitations [a]–[d] of claim 1, and also includes additional recitations. *Id.* at 45:13–23 (additionally reciting a "circular housing including a planar surface" and a "grid pattern").

E. Applied References

Petitioner relies upon the following references:

Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");

Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");

Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[2] and

Y. Mendelson, et al., "Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Association for the Advancement of Medical Instrumentation, Vol. 22, No. 4, 167–173 (1988) (Ex. 1015, "Mendelson-1988").

Pet. 2. Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003).

F. Asserted Grounds

Petitioner asserts that claims 1–6, 8–16, 18, and 19 are unpatentable based upon the following grounds (Pet. 2):[3]

Claims Challenged	35 U.S.C. §	References/Basis
1–6, 8–16, 18, and 19	103	Aizawa, Inokawa

[2] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). Ex. 1008, 24. In this Decision, we also refer to the translation.

[3] In a section titled "Challenge," Petitioner asserts, *inter alia*, that claims 17, 18, and 29 are unpatentable over 35 U.S.C. § 103 based on the combination of Mendelson-1988, Inokawa, Mendelson-2006 and Beyer. Pet. 1–2. However, Mendelson-2006 and Beyer are not listed as exhibits in the Petition (*see id.* at ii–iii), were not produced into the record as evidence, and Petitioner does not present any arguments regarding the patentability of claims 17, 18, and 29 over these references. Because Petitioner has not produced Mendelson-2006 and Beyer as evidence in this proceeding, and because Petitioner has not argued this ground in the Petition, we understand this identification in the table of grounds on pages 1–2 to be inadvertent error, and we do not consider this ground challenging claims 17, 18, and 29 based on Mendelson-1988, Inokawa, Mendelson-2006 and Beyer as part of the Petition. Notably, claims 17 and 29 are not addressed *anywhere* in the Petition, and thus will not be addressed in the final written decision. *See also* Pet. 1 (identifying the challenged claims as only "claims 1–6, 8–16, 18, and 19," and omitting claims 17 and 29).

Claims Challenged	35 U.S.C. §	References/Basis
1–6, 8–16, 18, and 19	103	Aizawa, Inokawa, Ohsaki
1–6, 8–16, 18, and 19	103	Mendelson-1988, Inokawa

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 4.

Based on our analysis of the issues in dispute at this stage of the proceeding, we conclude that no further claim terms require express construction at this time. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-

obviousness.[4] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 4 (citing Ex. 1003 ¶¶ 21–22). Petitioner also notes that a person of ordinary skill in the art ("POSITA") "could have also had a Master of

[4] Patent Owner does not present objective evidence of non-obviousness at this stage.

Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

For purposes of this Decision, we generally adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa and Inokawa

Petitioner presents undisputed contentions that claims 1–6, 8–16, 18, and 19 of the '266 patent would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 7–44.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled "Pulse Wave Sensor and Pulse Rate Detector," and discloses a pulse wave sensor that detects light output from a light emitting diode and reflected from a patient's artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

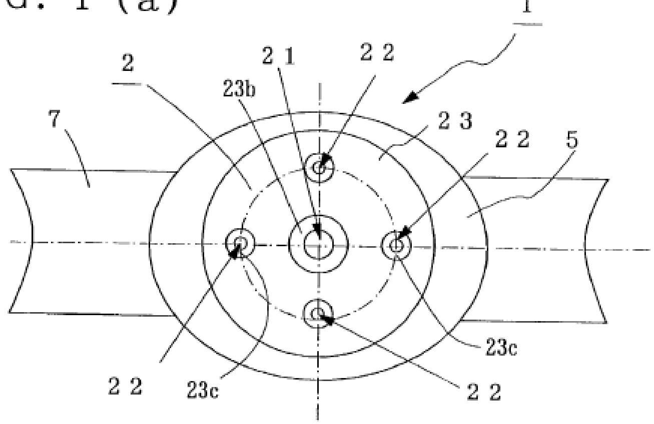

Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode ("LED") 21, four photodetectors 22 symmetrically disposed around LED 21, and

holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, “to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased.” *Id.* ¶ 32, Fig. 4(a). “The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22.” *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

FIG. 1 (b)

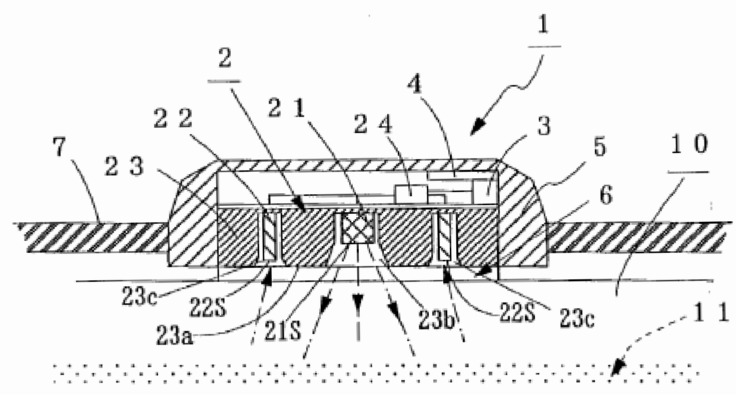

Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an “unshown display.” *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id*.

Aizawa discloses LED 21 and photodetectors 22 “are stored in cavities 23*b* and 23*c* formed in the detection face 23*a*” of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a “is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21*s* of the light emitting diode 21 and the light receiving faces 22*s* of the

photodetectors 22 are set back from the above detection face 23*a*." *Id*. Aizawa further discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 with a belt in such a manner that the light emitting face 21*s* of the light emitting diode 21 faces down (on the wrist 10 side)." *Id*. ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.*

2. *Overview of Inokawa (Ex. 1008)*

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

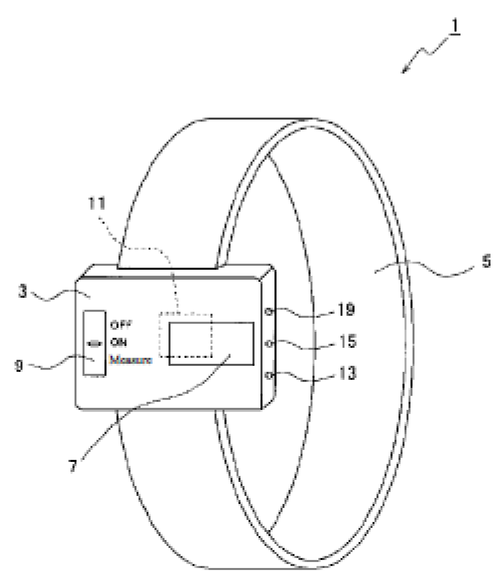

Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

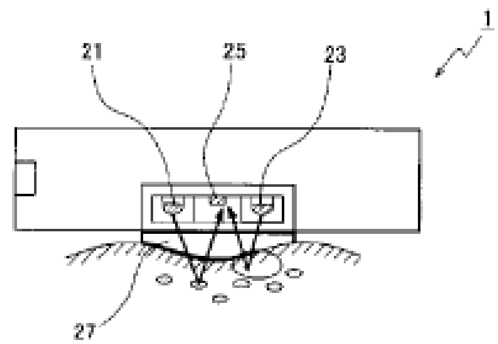

Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 senses "the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery)," and infrared LED 23 senses body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that "performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory." *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

(FIG. 3)

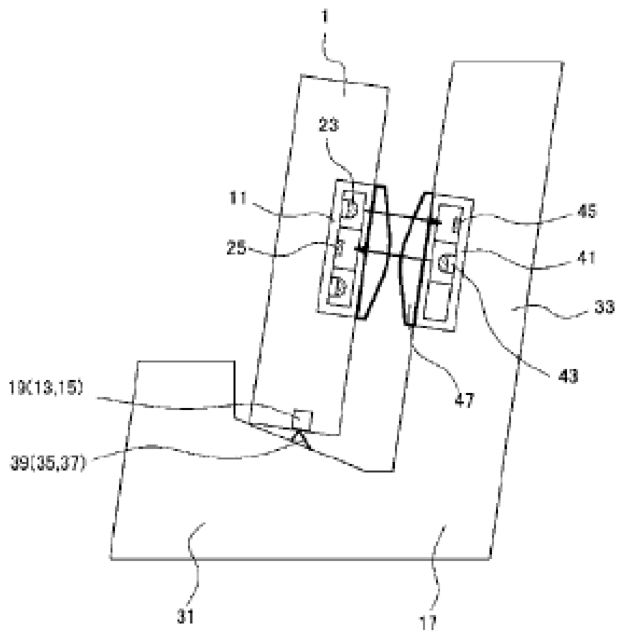

Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position, pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76–77. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Independent Claim 1 (Aizawa and Inokawa)

Petitioner presents undisputed contentions that claim 1 would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 23–30.

i. "A noninvasive optical physiological sensor comprising:"

On this record, the cited evidence supports Petitioner's undisputed contentions that Aizawa discloses this limitation. Pet. 23.

Figure 2 of Aizawa shows a user wearing a pulse wave sensor on the inner side of his/her wrist. Ex. 1006 ¶ 26. Accordingly, Petitioner's reliance on Figure 2 of Aizawa and the corresponding disclosure sufficiently disclose the subject matter of the preamble.[5] *See* Pet. 23.

At this stage of the proceeding, Petitioner's stated reasoning is sufficiently supported.

ii. "[a] a plurality of emitters configured to emit light into tissue of a user"

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 17–24.

Petitioner contends, "[w]hile Aizawa contemplates the use of multiple emitters, Aizawa never specifically identifies the use of multiple emitters operating at different wavelengths in conjunction with multiple detectors." Pet. 17 (citing Ex. 1006 ¶ 33; Ex. 1003 ¶¶ 69–80). We note that the claim language does not require multiple emitters operating at different

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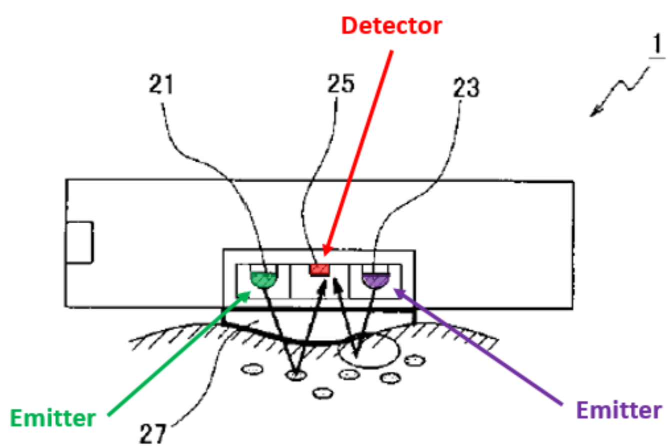
[5] Whether the preamble is limiting need not be resolved at this stage of the proceeding, because Petitioner shows sufficiently for purposes of institution that the recitation in the preamble is satisfied by the prior art.

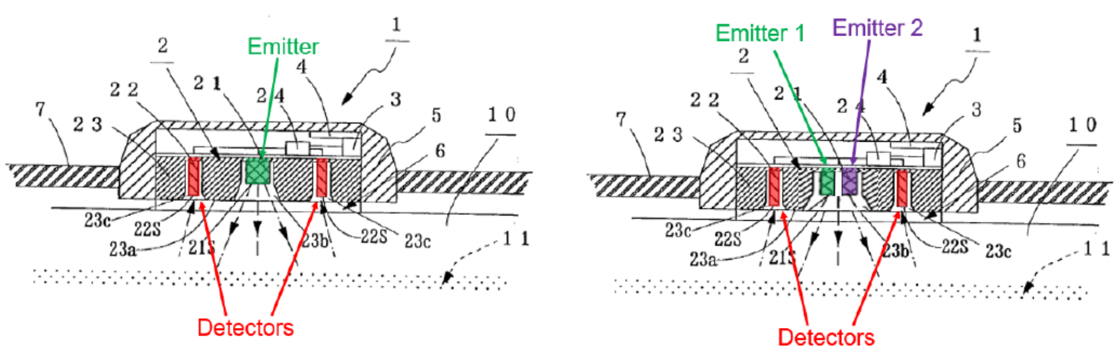
wavelengths. Thus, our patentability analysis is limited to what the claims actually recite.

Petitioner contends that a person of ordinary skill in the art would have found it obvious to incorporate the two LEDs of Inokawa into Aizawa. Pet. 24. Petitioner relies on Figure 1(b) of Aizawa, which shows pulse wave sensor 2 comprising a single LED 21 "for emitting light having a wavelength of near infrared range." Ex. 1006 ¶ 23. Inokawa teaches a pulse sensor comprising two LEDs–a sensor-side green LED for sensing "the pulse from the light reflected off of the body," and a sensor-side infrared LED for sensing "body motion from the change in this reflected light." Ex. 1008 ¶ 59; *see also id.* ¶ 14, Fig. 2. Petitioner's annotated Figure 2 of Inokawa is reproduced below.



Annotated Figure 2 depicts pulse sensor 1 comprising sensor-side photodiode 25 (shown in red) that receives reflected light from sensor-side green LED 21 (shown in green) and a sensor-side infrared LED 23 (shown in purple). Pet. 11; *see also* Ex. 1008 ¶ 58.

Petitioner contends that the teaching of Inokawa would motivate a person of ordinary skill in the art to modify the pulse wave sensor in Figure 1(b) of Aizawa to include "two different emitters operating at different wavelengths." Pet. 17. Specifically, Petitioner contends, "while Aizawa only expressly mentions using 'light having a wavelength of an infrared range' to detect the pulse rate, Inokawa discloses dividing the role of a single LED into two different LEDs, specifically 'with an infrared LED used to detect vital signs . . . and a green LED used to detect pulse.'" Pet. 17–18. Petitioner presents annotated and modified Figure 1(b) of Aizawa to illustrate the resulting pulse wave sensor of Aizawa when modified according to the teaching of Inokawa. Pet. 19. Petitioner's annotated and modified Figure 1(b) of Aizawa is reproduced below.



Annotated Figure 1(b) (left) depicts pulse wave sensor 2 comprising a single LED 21 (shown in green) emitting light to nearby photodetectors 22 (shown in red). Annotated and modified Figure 1(b) (right) depicts pulse wave sensor 2 configured with two LEDs (shown in green and purple and labeled as "Emitter 1" and "Emitter 2") emitting light to photodetectors 22 (shown in red). *Id.*

Petitioner reasons "[a] POSITA would have recognized, in view of Inokawa, that providing an additional emitter to Aizawa would allow

Aizawa's device to use it existing infrared LED to detect body motion while using the added green LED to detect pulse," and "[t]he added ability to measure body movement can allow for more reliable pulse measurement that takes into account and corrects for inaccurate readings stemming from body movement." Pet. 18 (citing Ex. 1003 ¶ 72).[6] According to Dr. Kenny, "[w]hile it's possible that adding more emitters to Aizawa may lead to increased power consumption, a POSITA seeking to improve detection performance would have nevertheless looked to Inokawa's multiple-emitter setup to achieve enhanced performance benefits." Ex. 1003 ¶ 72.

At this stage of the proceeding, Petitioner's stated reasoning for modifying Aizawa to include two LEDs is sufficiently supported, including by the unrebutted testimony of Dr. Kenny.

Petitioner provides an additional rationale "for improving Aizawa by adding a second/LED emitter." Pet. 20. Specifically, Petitioner references the embodiment depicted in Figure 19 of Inokawa disclosing a base device configured to transmit data from a sensor using a green LED and an infrared LED. Pet. 21–23; *see also* Ex. 1008 ¶¶ 109–111 (describing sensor-side green LED 165 and sensor-side infrared LED 163 for transmitting data to base-side photodetectors 155, 157); Fig. 3 (depicting a base device comprising multiple sensor-side LEDs). As we explain *supra*, the record before us sufficiently supports Petitioner's contentions regarding modifying

[6] Petitioner provides additional reasoning "for improving Aizawa by adding a second/LED emitter." Pet. 20. Specifically, Petitioner references the embodiment depicted in Figure 19 of Inokawa disclosing a base device configured to transmit data from a sensor using a green LED and an infrared LED. Pet. 21–23. Based on the record before us, we need not consider that additional reasoning at this stage of the proceeding.

Figure 1(b) of Aizawa to include the green and infrared LEDs depicted in Figure 2 of Inokawa. Thus, further analysis of Petitioner's proposal to modify Figure 1(b) of Aizawa based on the teachings of Figure 19 of Inokawa is unnecessary.

iii. "[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors"

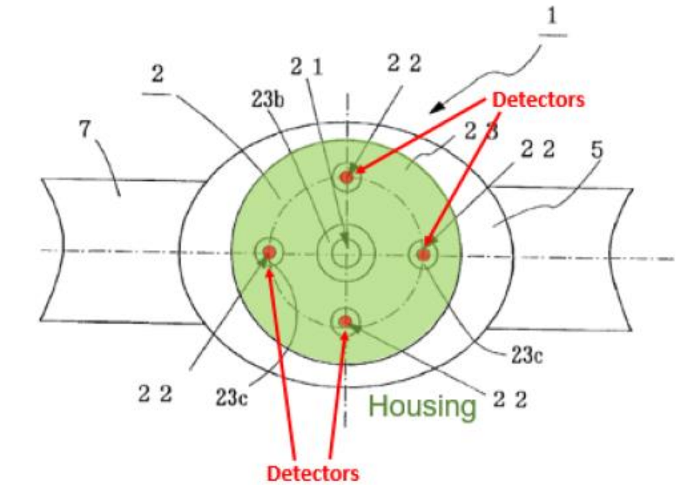
On this record, the cited evidence supports Petitioner's undisputed contention that Figure 1(a) of Aizawa discloses four "photodetectors 22 . . . [that] detect light 'reflected by a red corpuscle running through the artery 11 of the wrist 10.'" Pet. 25 (quoting Ex. 1006 ¶ 27); *see, e.g.*, Ex. 1006, Fig. 1(a) (depicting four photodetectors 22); *id.* ¶ 27 ("[F]our photodetectors 22 are disposed around the light emitting diode 21.").

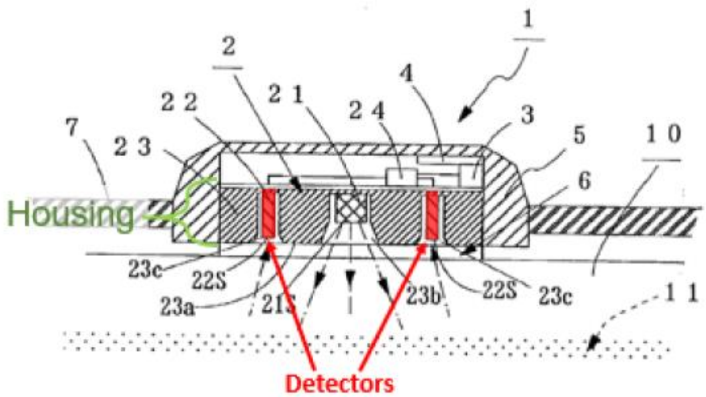
At this stage of the proceeding, Petitioner's stated reasoning is sufficiently supported.

iv. "[c] a housing configured to house at least the plurality of detectors; and"

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 25–26.

Petitioner contends "the holder of Aizawa provides a housing that houses the plurality of detectors." Pet. 26. In support of this contention, Petitioner provides annotated Figures 1(a) and 1(b) of Aizawa, reproduced below.





Annotated Figure 1(a) (top) is a plan view of pulse wave sensor 2, and depicts holder 23 (highlighted in green) surrounding photodetectors 22 (shown in red). Pet. 26; *see also* Ex. 1006 ¶ 23; Ex. 1003 ¶ 84. Annotated Figure 1(b) (bottom) is a sectional view of pulse wave sensor 2, and depicts holder 23 (labeled in green text as "Housing") surrounding photodetectors 22 (shown in red). Pet. 26.

At this stage of the proceeding, Petitioner's stated reasoning is sufficiently supported.

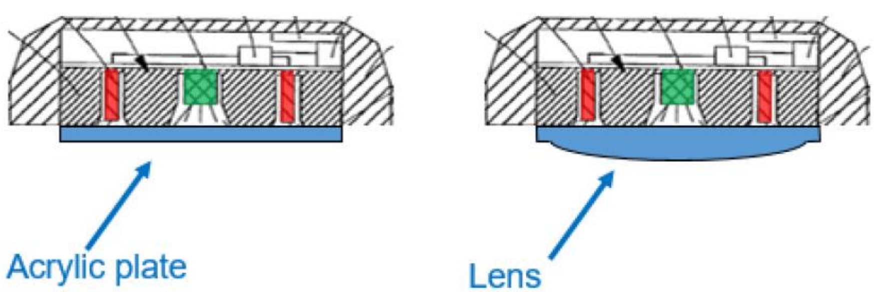
v. "[d] a lens configured to be located between the tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor worn by the user and during operation of the noninvasive optical physiological sensor."

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 13–17, 26–30.

Figure 1(b) of Aizawa teaches a pulse wave sensor comprising an acrylic transparent plate 6. Ex. 1006 ¶ 30 "Since the acrylic transparent plate 6 is provided on the detection face 23*a* of the holder 23, adhesion between the pulse rate detector 1 and the wrist 10 can be improved." *Id*. As shown in Figure 1(b), the acrylic transparent plate is notably flat in shape and is arranged between photodetectors 22 and a person's wrist 10. Similarly, Figure 2 of Inokawa teaches a pulse wave sensor comprising lens 27 that appears to protrude toward a person's body, and is arranged between photodetector 25 and the person's body. Petitioner contends "the 'lens makes it possible to increase the light-gathering ability of the LED'" (Pet. 14–15 (citing Ex. 1008 ¶ 15)), and that the lens achieves increased light collection efficiency by "refracting/concentrating the incoming light signals reflected by the blood" (Pet. 15 (citing Ex. 1003 ¶¶ 88–89)).

Dr. Kenny testifies "the acrylic plate of Aizawa is flat and is not described as including a lens" (Ex. 1003 ¶ 86), but that "a POSITA would have been able to look to Inokawa to enhance light collection efficiency . . . by modifying the light permeable cover of Aizawa to include a convex

protrusion that acts as a lens, as per Inokawa" (*id.* ¶ 87). *See* Ex. 1008 ¶ 107 (describing an embodiment where the sensor-side optical device component is convex), ¶ 99 ("[T]he pulse sensor [sensor]-side optical device component is convex."). Based on the testimony of Dr. Kenny, Petitioner proposes modifying the flat-shaped acrylic transparent plate 6 of Aizawa to include a convex-shaped lens as taught by Inokawa, in order to "increase the light collection efficiency, which would lead to more reliable pulse detection." Pet. 15 (citing Ex. 1003 ¶¶ 88–89). Petitioner's annotated Figure 1(b) of Aizawa, and modified Figure 1(b) of Aizawa based on Inokawa's teaching of a protruding convex-shaped lens, are reproduced below.



Annotated Figure 1(b) of Aizawa (left) depicts a pulse wave sensor comprising flat acrylic transparent plate 6 (shown in blue) arranged below photodetectors (shown in red). Pet. 15, 28. Modified Figure (1b) of Aizawa (right) depicts the acrylic transparent plate 6 modified to include a convex lens (shown in blue) as taught by Inokawa. *Id.*

In addition to Petitioner's stated reasoning that the convex lens of Inokawa would "increase the light collection efficiency" of the pulse sensor of Aizawa (Pet. 15), Petitioner further reasons a person of ordinary skill in the art would prioritize a convex lens over a flat cover, such as acrylic transparent plate 6 shown in Figure 1(b) of Aizawa, even though Inokawa

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teaches that a flat cover is "less prone to scratches." Pet. 16 (citing Ex. 1008 ¶ 106 ("Another advantage is that, because the surface of the covers . . . is flat, the surface is less prone to scratches than when the lens protrudes.")). Relying on the testimony of Dr. Kenny, Petitioner contends "a POSITA making the design choice to prioritize improved light collection efficiency over reduced susceptibility to scratches could have readily modified Aizawa's cover to have a lens as per Inokawa." Pet. 16 (citing Ex. 1003 ¶ 91).

On the record before us, we find persuasive Petitioner's stated reasoning regarding modifying the flat cover of Aizawa to include a convex lens.

Petitioner further contends, the pulse wave sensor of Aizawa (as modified by Inokawa) "will cause the tissue of the user to further conform around the convex surface of the lens when the device is pressed against the tissue" and that, "because the cover of Aizawa is made of transparent acrylic, . . . a well-known rigid material, it would be sufficiently rigid to deform the tissue." Pet. 29–30 (citing Ex. 1003 ¶¶ 92–93, 98); *see also* Ex. 1008, Fig. 2 (depicting convex sensor-side lens pressing into and conforming the skin of the user's body). Dr. Kenny testifies to the benefits of a rigid lens, such as the acrylic convex lens 6 of Aizawa (as modified by Inokawa). In particular, Dr. Kenny states "a rigid lens would be far better as compared to a 'pliable lens' . . . in providing the improved optical performance and light-gathering function as contemplated in the combination [of Aizawa and Inokawa]," and reasons that "[a] POSITA would use a lens material that was more rigid than the tissue it is meant to come into contact with and deform in order to achieve the benefits of

improved optical efficiency." Ex. 1003 ¶ 99. We find persuasive Petitioner's stated reasons regarding Aizawa/Inokawa's acrylic convex lens tissue conforming properties.

vi. Summary

For the foregoing reasons, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

4. Claims 2–6 and 8

Petitioner presents undisputed contentions that dependent claims 2–6 and 8, which depend directly or indirectly from independent claim 1, are unpatentable over the combined teachings of Aizawa and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 30–35; *see also* Ex. 1003 ¶¶ 94–103, 105.

Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. *See* PO Waiver. We have reviewed these arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions.

Moreover, as discussed in detail above, Petitioner has demonstrated a reasonable likelihood of prevailing on the challenge to claim 1 over the combined teachings of Aizawa and Inokawa. Therefore, pursuant to USPTO policy implementing the decision in *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348 (2018) ("*SAS*"), we institute as to all claims challenged in the petition and on

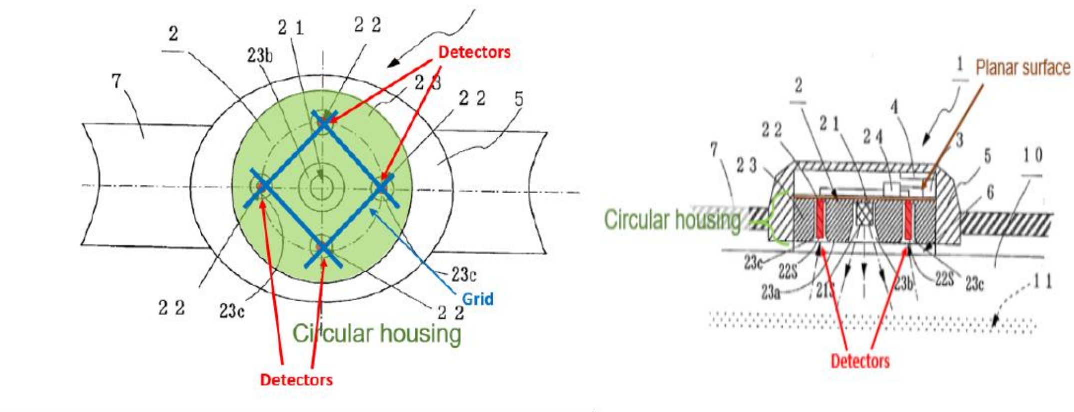
all grounds in the petition. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated Guide"),[7] 5–6, 64.

5. Independent Claim 9 (Aizawa and Inokawa)

Independent claim 9 consists of limitations that are substantially similar to limitations [a]–[d] of claim 1. *Compare* Ex. 1001, 44:37–54, *with id.* at 45:13–23 (reciting "a housing" as opposed to "a circular housing including a planar surface"; "at least four detectors" as opposed to "at least four detectors arranged on the planar surface" and "the four detectors are arranged in a grid pattern"; "a lens" as opposed to "a lens forming a cover" and omitting details of the lens' location; the sensor is "worn by the user" as compared to omitting details regarding user wear).

In asserting that claim 9 also would have been obvious over the combined teachings of Aizawa and Inokawa, Petitioner refers to the same arguments presented as to claim 1 (Pet. 35–36, 39 ("*See supra* Ground 1A")) and also presents additional arguments corresponding to the claimed "circular housing," "planar surface," and "grid pattern" limitations (Pet. 36–39). Specifically, Petitioner presents modified and annotated Figures 1(a) and (1b) of Aizawa (reproduced below) to demonstrate the claimed circular housing and planar surface.

[7] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.



Annotated Figure 1(a) (left) depicts pulse wave sensor 2 comprising holder 23 with detectors 22 arranged in a standard north, south, east, west grid pattern (depicted in blue). Pet. 38. The circular shape of the holder is highlighted in green. *Id*. Annotated Figure 1(b) (right) depicts pulse wave sensor 2 comprising holder 23 (labeled in green text as "Circular housing"). Pet. 36. The holder is adjacent to a surface, highlighted in brown, that Petitioner equates to the claimed "planar surface." *Id*.

For the same reasons discussed above, we are persuaded that Petitioner's cited evidence and reasoning demonstrate a reasonable likelihood that Petitioner would prevail in its contentions regarding independent claim 9. *See supra* II.D.3.i–v.

6. Claims 10–16, 18, and 19

Petitioner presents undisputed contentions that dependent claims 10–16, 18, and 19, which depend directly or indirectly from independent claim 9, are unpatentable over the combined teachings of Aizawa and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 39–44; *see also* Ex. 1003 ¶¶ 114–121, 123–124.

Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. *See* PO Waiver. We have reviewed these arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions.

Moreover, as discussed in detail above, Petitioner has demonstrated a reasonable likelihood of prevailing on the challenge to claim 9 over the combined teachings of Aizawa and Inokawa. Therefore, pursuant to USPTO policy implementing the decision in *SAS*, we institute as to all claims challenged in the Petition and on all grounds in the Petition. *See* Consolidated Guide, 5–6, 64.

E. Obviousness over the Combined Teachings of Aizawa, Inokawa, and Ohsaki

Petitioner presents undisputed contentions that claims 1–6, 8–16, 18, and 19 of the '266 patent would have been obvious over the combined teachings of Aizawa, Inokawa, and Ohsaki. Pet. 44–46. Ohsaki is relied upon to provide "an additional motivation and rationale for a POSITA to modify Aizawa to include a 'lens' as per element [1d]." Pet. 46. Petitioner contends that remaining claim limitations [1a]–[1c] are unpatentable for the same reasons raised with respect to the challenge of claim 1 based on the combination of Aizawa and Inokawa. *Id.* ("The resulting combination would have provided all remaining elements . . . in the same manner previously described in Ground 1A.").

1. Overview of Ohsaki (Ex. 1014)

Ohsaki is a U.S. patent application publication titled "Wristwatch-type Human Pulse Wave Sensor Attached on Back Side of User's Wrist," and

discloses an optical sensor for detecting a pulse wave of a human body. Ex. 1014, code (54), ¶ 3. Figure 1 of Ohsaki is reproduced below.

FIG. 1

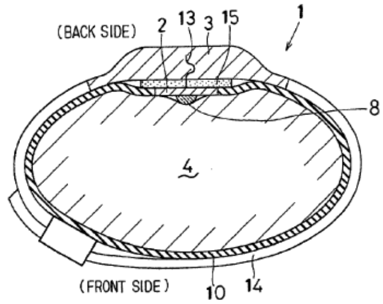


Figure 1 illustrates a cross-sectional view of pulse wave sensor 1 attached on the back side of user's wrist 4. *Id.* ¶¶ 12, 16. Pulse wave sensor 1 includes detecting element 2 and sensor body 3. *Id.* ¶ 16.

Figure 2 of Ohsaki, reproduced below, illustrates further detail of detecting element 2.

FIG. 2

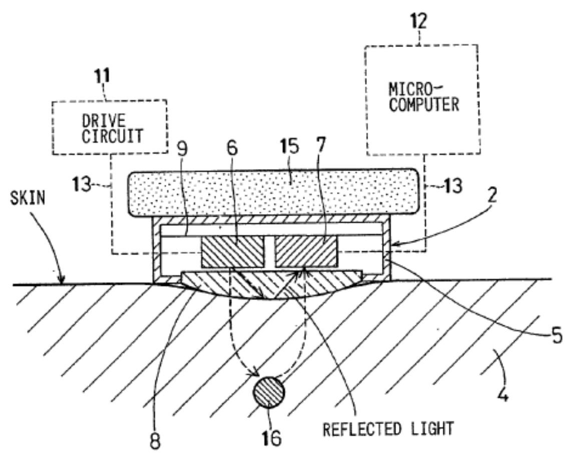


Figure 2 illustrates a mechanism for detecting a pulse wave. *Id.* ¶ 13. Detecting element 2 includes package 5, light emitting element 6, light receiving element 7, and translucent board 8. *Id.* ¶ 17. Light emitting element 6 and light receiving element 7 are arranged on circuit board 9 inside package 5. *Id.*

"[T]ranslucent board 8 is a glass board which is transparent to light, and attached to the opening of the package 5. A convex surface is formed on the top of the translucent board 8." *Id*. "[T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin," preventing detecting element 2 from slipping off the detecting position of the user's wrist. *Id.* ¶ 25. Ohsaki describes that when a translucent board has a flat surface, the detected pulse wave may be adversely affected by movement of the user's wrist. *Id.* By preventing the detecting element from slipping, the convex surface suppresses "variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin." *Id.* Additionally, the convex surface prevents penetration by "noise such as disturbance light from the outside." *Id.*

Sensor body 3 is connected to detecting element 2 by signal line 13. *Id.* ¶ 20. Signal line 13 connects detecting element 2 to drive circuit 11, microcomputer 12, and a monitor display (not shown). *Id.* Drive circuit 11 drives light emitting element 6 to emit light toward wrist 4. *Id.* Detecting element 2 receives reflected light which is used by microcomputer 12 to calculate pulse rate. *Id.* "The monitor display shows the calculated pulse rate." *Id.*

2. Independent Claim 1 (Aizawa, Inokawa, and Ohsaki)

Petitioner presents undisputed contentions that claim 1 would have been obvious over the combined teachings of Aizawa, Inokawa, and Ohsaki. Pet. 45–46.

i.[1a]–[1c]

Petitioner contends claim limitations [1a]–[1c] are unpatentable for the same reasons raised with respect to Petitioner's challenge based on the combination of Aizawa and Inokawa. Pet. 46 ("The resulting combination would have provided all remaining elements . . . in the same manner previously described in Ground 1A"). The ground based on Aizawa and Inokawa is addressed *supra* at II.D.3.(i)–(iv). At this stage of the proceeding, Petitioner's stated reasoning with respect to these limitations, and the basis for combining Aizawa and Inokawa, is sufficiently supported, including by the unrebutted testimony of Dr. Kenny.

i."[d] a lens configured to be located between the tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor worn by the user and during operation of the noninvasive optical physiological sensor."

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation and the rationale for combining Ohsaki with Aizawa and Inokawa. Pet. 45–46.

As noted *supra* at section II.D.3.v, we find persuasive Petitioner's rationale for modifying the flat-shaped acrylic plate of Aizawa to include a convex-shaped lens as taught by Inokawa. Petitioner contends that "Ohsaki provides an additional motivation and rationale for a POSITA to modify Aizawa." Pet. 46.

Ohsaki teaches a pulse wave sensor comprising a translucent board 8 that is "intimate contact with the surface of the user's skin." Ex. 1014 ¶ 25. "If the translucent board 8 has a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist." *Id.* In the alternative, the translucent board may be configured with a convex surface to suppress variations in the amount of reflected light. *Id.*

Petitioner contends "Ohsaki teaches that adding a convex surface to a flat cover . . . can help prevent the device from slipping on the tissue" and that Aizawa is also concerned with preventing slippage. Pet. 46 (citing Ex. 1006 ¶¶ 26, 30; Ex. 1014 ¶ 25); *see* Ex. 1006 ¶ 26 ("[A]dhesion between the wrist 10 and the pulse rate detector 1 is improved."). Petitioner reasons "a POSITA wanting to achieve improved adhesion between the detector and the skin, as expressly recognized in Aizawa, would have readily modified Aizawa's cover to have a convex protrusion as per Ohsaki." Pet. 46.

At this stage of the proceeding, Petitioner's stated reasoning is sufficiently supported.

F. Remaining Grounds of Obviousness

As discussed in detail above, Petitioner has demonstrated a reasonable likelihood of prevailing on the challenge to claims 1 and 9 as having been obvious over Aizawa and Inokawa, and the challenge to claim 1 as having been obvious over Aizawa, Inokawa, and Ohsaki. Therefore, pursuant to USPTO policy implementing the decision in *SAS*, we institute as to all claims challenged in the Petition and on all grounds in the Petition. *See* Consolidated Guide, 5–6, 64.

III. CONCLUSION

The Supreme Court held that a final written decision under 35 U.S.C. § 318(a) must decide the patentability of all claims challenged in the petition. *See SAS*, 138 S. Ct. 1348. After considering the evidence and arguments presented in the Petition, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least claims 1 and 9 of the ’266 patent are unpatentable. Accordingly, we institute an *inter partes* review of all claims and all grounds set forth in the Petition.

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–6, 8–16, 18, and 19 of the ’266 patent is instituted with respect to all grounds set forth in the Petition, as best understood and as set forth in Section I.F of this Decision (*see supra* n.3); and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the ’266 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

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Paper 7
Date: June 3, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00209
Patent 10,376,191 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges.*

WIEKER, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–6, 8–16, 18, and 19 ("challenged claims") of U.S. Patent No. 10,376,191 B1 (Ex. 1001, "the '191 patent"). Paper 2 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a preliminary response. Paper 6 ("PO Waiver").

We have authority to determine whether to institute an *inter partes* review, under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that "the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) ("The Board institutes the trial on behalf of the Director.").

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that Petitioner would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Related Matters

The parties identify the following matters related to the '191 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01715 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,631,765 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1)

Apple Inc. v. Masimo Corporation, IPR2021-00193 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,299,708 B1);

Apple Inc. v. Masimo Corporation, IPR2021-00195 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,376,190 B1); and

Apple Inc. v. Masimo Corporation, IPR2021-00208 (PTAB Nov. 20, 2020) (challenging claims of U.S. Patent No. 10,258,266 B1).

Pet. 71–72; Paper 3, 3–4.

Patent Owner further identifies the following pending patent applications, among other issued and abandoned applications, that claim priority to, or share a priority claim with, the ’191 patent:

U.S. Patent Application No. 16/834,538;

U.S. Patent Application No. 17/031,407;

U.S. Patent Application No. 17/031,316;

U.S. Patent Application No. 17/031,356;

U.S. Patent Application No. 16/449,143; and

U.S. Patent Application No. 16/805,605.

Paper 3, 1–3.

C. The '191 Patent

The '191 patent is titled "Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents," and issued on August 13, 2019, from U.S. Patent Application No. 16/409,515, filed May 10, 2019. Ex. 1001, codes (21), (22), (45), (54). The '191 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The '191 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:35–37. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:26–32, 61–62. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:42–45.

Figure 1 of the '191 patent is reproduced below.

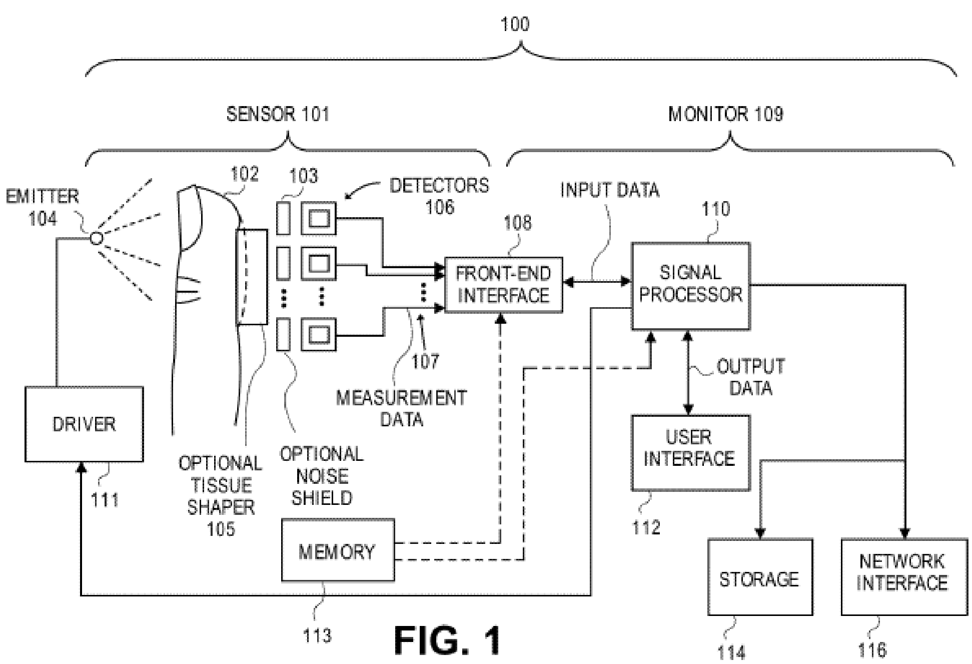


FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:42–44. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:54–56. Emitters 104 emit light that is attenuated or reflected by the patient's tissue at measurement site 102. *Id.* at 13:67–14:3. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 14:3–6, 14:22–28. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 10:57–11:9.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:12–14. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:17–20. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:42–55. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:56–62.

The '191 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

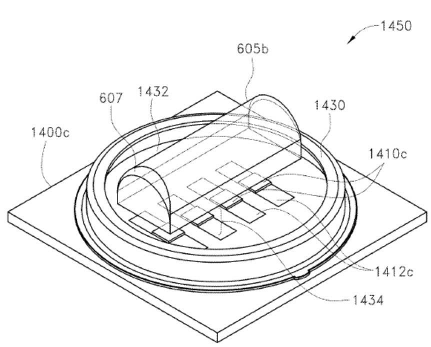


FIG. 14D

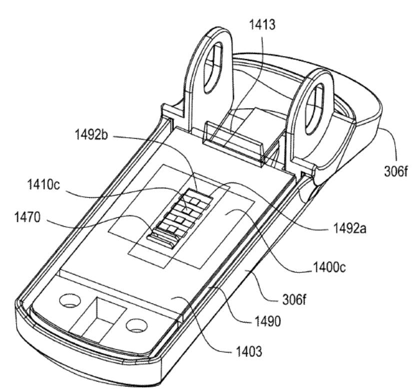


FIG. 14F

Figure 14D illustrates portions of a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:40–43. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:36–40, 36:30–37. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 37:9–17. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* at 37:18–25. Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:47–49.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

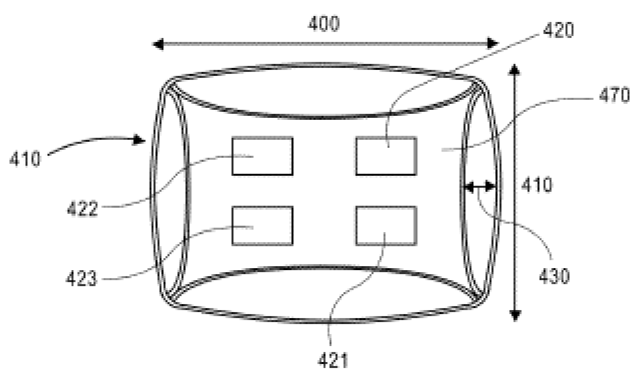


FIG. 4A

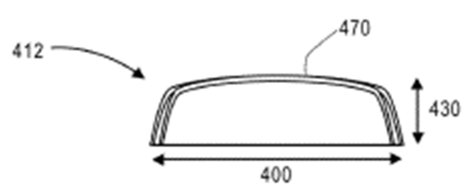


FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:13–19. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:36–38. The measurement site contact area may

include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:44–58.

D. Illustrative Claim

Of the challenged claims, claims 1 and 9 are independent. Claim 1 is illustrative and is reproduced below.

> 1. A noninvasive optical physiological sensor comprising:
>
> [a] a plurality of emitters configured to emit light into tissue of a user;
>
> [b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors;
>
> [c] a housing configured to house at least the plurality of detectors in a circular portion of the housing; and
>
> [d] a lens configured to be located between tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor is worn by the user and during operation of the noninvasive optical physiological sensor.

Ex. 1001, 44:50–67 (bracketed identifiers a–d added). Independent claim 9 includes limitations similar to limitations [a]–[d] of claim 1. *Id.* at 45:26–36 (reciting a "planar surface" and "at least four detectors" arranged in a "grid pattern" on the planar surface).

E. Applied References

Petitioner relies upon the following references:

Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1014, "Ohsaki");

Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");

Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[1] and

Y. Mendelson et al., "Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Association for the Advancement of Medical Instrumentation, Vol. 22, No. 4, 167–173 (1988) (Ex. 1015, "Mendelson-1988").

Pet. 3. Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003).

F. Asserted Grounds

Petitioner asserts that claims 1–6, 8–16, 18, and 19 are unpatentable based upon the following grounds:

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–6, 8–16, 18, 19	103	Aizawa, Inokawa
1–6, 8–16, 18, 19	103	Aizawa, Inokawa, Ohsaki
1–6, 8–16, 18, 19	103	Mendelson-1988, Inokawa

[1] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). In this Decision, we also refer to the translation.

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 3–4.

Based on our analysis of the issues in dispute at this stage of the proceeding, we agree that no claim terms require express construction at this time. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-obviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether

[2] Patent Owner does not present objective evidence of non-obviousness at this stage.

there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person having "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 4 (citing Ex. 1003 ¶¶ 21–22). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

For purposes of this Decision, we generally adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa and Inokawa

Petitioner presents undisputed contentions that claims 1–6, 8–16, 18, and 19 of the ’191 patent would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 6–43.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled “Pulse Wave Sensor and Pulse Rate Detector,” and discloses a pulse wave sensor that detects light output from a light emitting diode and reflected from a patient’s artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

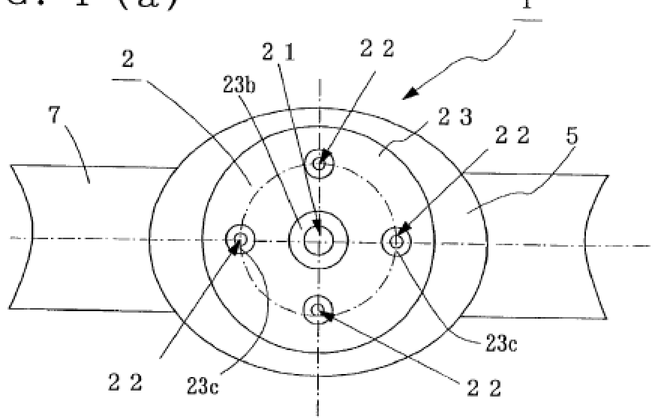


Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode (“LED”) 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, “to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased.” *Id.* ¶ 32, Fig. 4(a). “The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22.” *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

FIG. 1 (b)

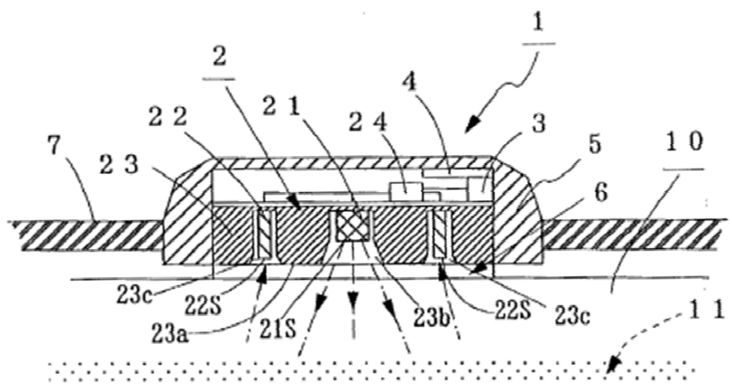


Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* ¶ 23. Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.* ¶ 23.

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* ¶ 24. Aizawa discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)." *Id.* ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic

transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. Overview of Inokawa (Ex. 1008)

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

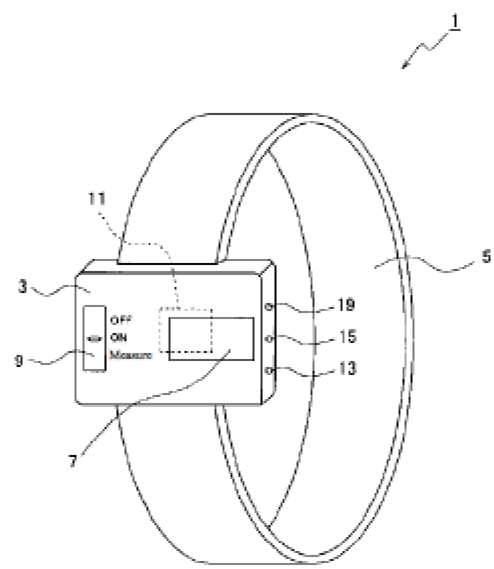


Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

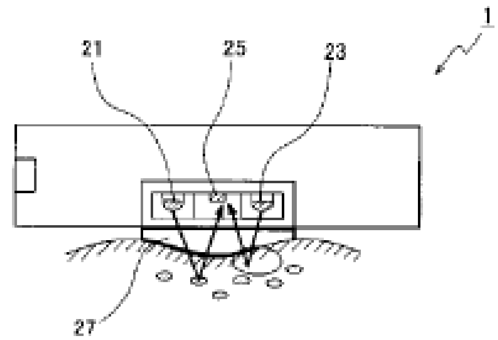


Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 senses “the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery),” and infrared LED 23 senses body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that “performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory.” *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

(FIG. 3)

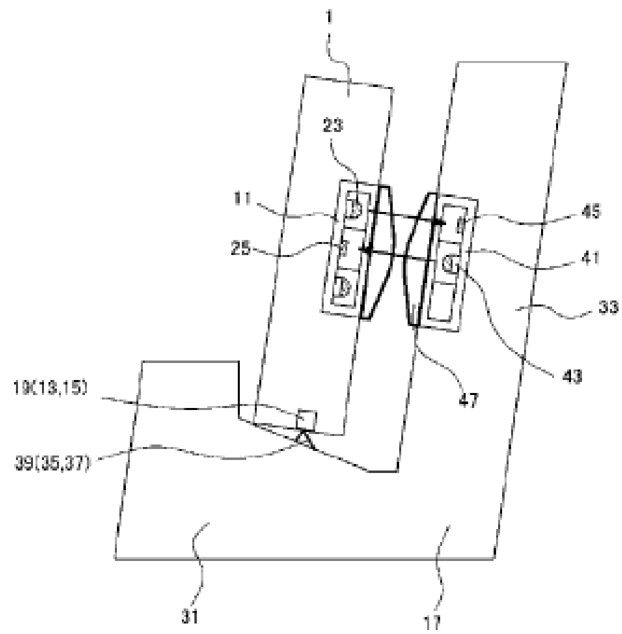


Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position, pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Independent Claim 1

Petitioner presents undisputed contentions that claim 1 would have been obvious over the combined teachings of Aizawa and Inokawa. Pet. 13–22 (combination), 22–29 (claim 1).

i. "A noninvasive optical physiological sensor comprising"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses a pulse sensor. Pet. 22–23; *see, e.g.*, Ex. 1006 ¶ 2 ("[A] pulse wave sensor for detecting the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist with light.").

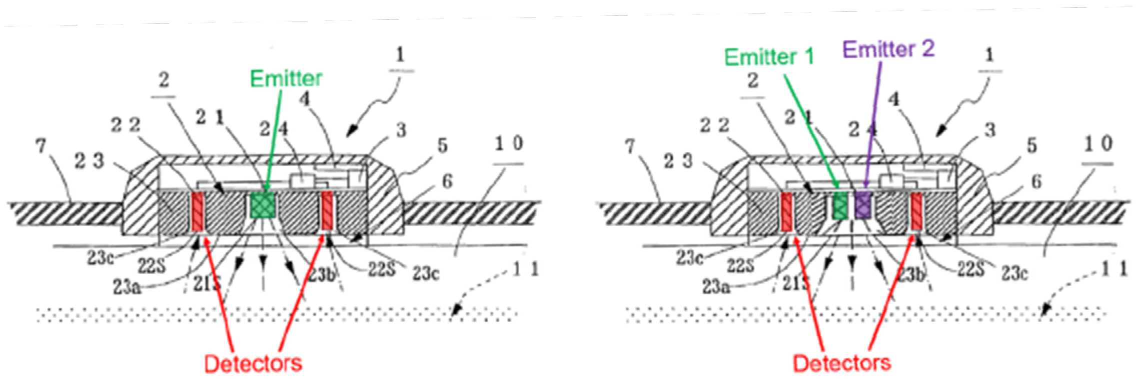
ii. "[a] a plurality of emitters configured to emit light into tissue of a user"

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Specifically, Petitioner contends that Aizawa discloses LED 21. Pet. 7; *see, e.g.*, Ex. 1006 ¶ 23 ("LED 21 . . . for emitting light having a wavelength of a near infrared range"). Petitioner also contends that Inokawa discloses using two emitters of different wavelengths and that "work can be divided between the various means, with an infrared LED used to detect vital signs and transmit vital sign information, and a green LED used to detect pulse." Pet. 10–11, 17; *see, e.g.*, Ex. 1008 ¶¶ 14 (quoted), 58 (a pair of LEDs 21, 23), 59 (detecting pulse and body motion). Petitioner also contends that when Inokawa's sensor is mounted on its base device, vital information is transmitted to the base device through the LEDs. Pet. 12–13; *see, e.g.*, Ex. 1008 ¶¶ 76–77 (explaining that "vital sign information stored in the memory 63 [of the sensor], such as pulse and body

motion, is transmitted to the base device 17 using the S-side infrared LED 23 of the pulse sensor 1 and the B-side PD 45 of the base device 17," such that "there is no need to use a special wireless communication circuit or a communication cable").

Petitioner further contends that a person of ordinary skill in the art would have been motivated to "provid[e] an additional emitter to Aizawa [to] allow Aizawa's device to use its existing infrared LED to detect body motion while using the added green LED to detect pulse," which would have provided "more reliable pulse measurement that takes into account and corrects for inaccurate readings stemming from body movement." Pet. 17–18, 24; *see also id.* at 19–22, 24 (contending the combination also would have provided for wireless communication through the LEDs); Ex. 1003 ¶¶ 71–73.

To illustrate its proposed modification, Petitioner includes annotated and modified views of Aizawa's Figure 1(b), reproduced below. Pet. 18; *see also id.* at 23 (same); Ex. 1003 ¶ 72.



Petitioner's modified figures depict the sensor of Aizawa in which the single emitter has been divided into two emitters operating at two different wavelengths, as Petitioner contends would have been rendered obvious by Inokawa. *Id.* at 18–19, 23–24.

At this stage of the proceeding, Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 69–81.

iii. "[b] a plurality of detectors configured to detect light that has been attenuated by tissue of the user, wherein the plurality of detectors comprise at least four detectors"

On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses at least four detectors 22 that detect light that has been emitted by LED 21 and attenuated by body tissue. Pet. 24–25; *see, e.g.*, Ex. 1006 ¶ 27 (disclosing that light emitted from LED 21 "is reflected by a red corpuscle running through the artery 11 of the wrist 10 and . . . is detected by the plurality of photodetectors 22 so as to detect a pulse wave"); Ex. 1003 ¶¶ 82–83.

iv. "[c] a housing configured to house at least the plurality of detectors in a circular portion of the housing"

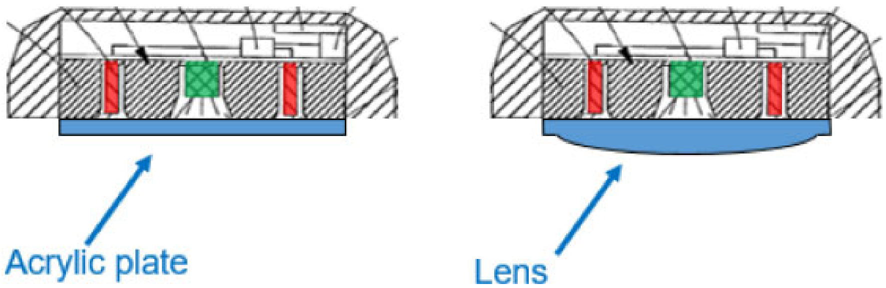
On this record, the cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23, which houses the detectors in a circular portion of the housing. Pet. 25; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing . . . light emitting diode 21 and the photodetectors 22"), Figs. 1(a)–(b) (depicting circular holder 23 surrounding detectors 22).

v. "[d] a lens configured to be located between tissue of the user and the plurality of detectors when the noninvasive optical physiological sensor is worn by the user, wherein the lens comprises a single outwardly protruding convex surface configured to cause tissue of the user to conform to at least a portion of the single outwardly protruding convex surface when the noninvasive optical physiological sensor is worn by the user and during operation of the noninvasive optical physiological sensor"

On this record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 13–17, 26–29. Specifically, Petitioner contends that Aizawa discloses a cover in the form of an "acrylic transparent plate" that is mounted at the detector face of the sensor. *Id.* at 8–9, 26; Ex. 1006 ¶¶ 23, 34 ("[A]crylic transparent plate 6 is provided on the detection face 23a of the holder 23 to improve adhesion to the wrist 10."), Fig. 1(b) (depicting flat, transparent plate 6 between sensor 2 and wrist 10). Petitioner contends that Aizawa does not provide detail regarding the shape of the cover. Pet. 13–14. However, Petitioner contends that Inokawa teaches lens 27 positioned between its sensor and the wearer's skin, which increases the light gathering ability of the sensor. *Id.* at 11; *see, e.g.*, Ex. 1008 ¶¶ 15 ("This lens makes it possible to increase the light-gathering ability of the LED as well as to protect the LED or PD."), 58 (disclosing "a single photodiode (S-side PD) 25 that receives the reflected light from these [LEDs], and an S-side lens 27"), Fig. 2.

In light of these teachings, Petitioner contends that a person of ordinary skill in the art would have found it obvious to modify the flat acrylic plate of Aizawa to "incorporate an Inokawa-like lens into the cover of Aizawa to increase the light collection efficiency, which would lead to

more reliable pulse detection." Pet. 14–15, 27; Ex. 1003 ¶¶ 86–89. Petitioner provides annotated and modified views of Aizawa's Figure 1(b), reproduced below.



Pet. 14–15, 27; Ex. 1003 ¶ 89. Petitioner's annotated and modified figures depict Aizawa's sensor including its flat transparent plate (left) and a modified version of Aizawa's sensor in which the plate includes a convex protruding lens. Pet. 15, 23, 27; *see also id.* at 28–29 (depicting tissue conforming against convex protruding lens).

Petitioner contends this modification would have enjoyed a reasonable expectation of success because, for example, Inokawa teaches that the cover may be flat, like that of Aizawa, to reduce scratches, or in the form of a lens, as in Petitioner's proposed modification, to increase light gathering ability. *Id.* at 15–16; *see, e.g.*, Ex. 1008 ¶¶ 15 ("This lens makes it possible to increase the light-gathering ability."), 106 ("[B]ecause the surface of the covers 123, 131 is flat, the surface is less prone to scratches than when the lens protrudes."); Ex. 1003 ¶ 90.

At this stage of the proceeding, Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 85–93.

vi. Summary

For the foregoing reasons, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

4. Independent Claim 9

Independent claim 9 consists of limitations that are substantially similar to elements [a]–[d] of claim 1. *Compare* Ex. 1001, 44:50–67, *with id.* at 45:26–36 (reciting a "planar surface" and "at least four detectors" arranged in a "grid pattern" on the planar surface).

In asserting that claim 9 also would have been obvious over the combined teachings of Aizawa and Inokawa, Petitioner refers to substantially the same arguments presented as to claim 1. *See* Pet. 35–38; Ex. 1003 ¶¶ 106–113. For the same reasons discussed above, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 9. *See supra* II.D.3.i–v.

5. Dependent Claims 2–6, 8, 10–16, 18, and 19

Petitioner presents undisputed contentions that claims 2–6, 8, 10–16, 18, and 19, which depend directly or indirectly from independent claim 1 or 9, are unpatentable over the combined teachings of Aizawa and Inokawa, and provides arguments explaining how the references teach the limitations of these claims. Pet. 29–34, 38–43; Ex. 1003 ¶¶ 94–105, 114–124. Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. PO Waiver. We have reviewed Petitioner's arguments

and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions.

Moreover, as discussed in detail above, Petitioner has demonstrated a reasonable likelihood of prevailing on the challenge to claims 1 and 9. Therefore, pursuant to USPTO policy implementing the decision in *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348 (2018) ("*SAS*"), we institute as to all claims challenged in the petition and on all grounds in the petition. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated Guide")[3], 5–6, 64.

E. Other Grounds

Petitioner provides arguments and evidence, including the Kenny Declaration, in support of Petitioner's two other grounds challenging claims 1–6, 8–16, 18, and 19 of the '191 patent. Pet. 43–70; Ex. 1003 ¶¶ 125–175. Patent Owner does not offer, at this stage, any arguments addressing Petitioner's substantive showing. PO Waiver. We have reviewed Petitioner's arguments and the cited evidence, and we determine Petitioner has demonstrated a reasonable likelihood of prevailing as to these contentions. We institute review of all of these challenges. *See SAS*, 138 S. Ct. 1348; Consolidated Practice Guide, 5–6, 64.

III. CONCLUSION

The Supreme Court held that a final written decision under 35 U.S.C. § 318(a) must decide the patentability of all claims challenged in the petition. *SAS*, 138 S. Ct. 1348. After considering the evidence and

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[3] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

arguments presented in the Petition, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least claims 1 and 26 of the ’191 patent are unpatentable. Accordingly, we institute an *inter partes* review of all claims and all grounds set forth in the Petition.

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–6, 8–16, 18, and 19 of the ’191 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the ’191 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

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Filed July 27, 2022

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.

Petitioner,

v.

MASIMO CORPORATION,

Patent Owner.

IPR2021-00193
Patent 10,299,708

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgment – Final Written Decision (Paper 30) entered on June 1, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered June 3, 2021 (Paper 7). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1-29 of U.S. Patent 10,299,708 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2021-00193 involving Patent 10,299,708.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, to the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 27, 2022

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CERTIFICATE OF SERVICE

I hereby certify that the original of this Notice of Appeal was filed via U.S.P.S. Priority Mail Express on July 27, 2022 with the Director of the United States Patent and Trademark Office at the address below:

Office of the Solicitor
United States Patent and Trademark Office
Mail Stop 8, P.O. Box 1450
Alexandria, Virginia 22313-1450

A copy of this Notice of Appeal is being filed and served on July 27, 2022 as follows:

To the USPTO Patent Trial and Appeal Board:
Patent Trial and Appeal Board
Madison Building East
600 Dulany Street
Alexandria, VA 22313

(*via PTABe2e – as authorized by the Board*)

To the U.S. Court of Appeals for the Federal Circuit:
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Case: 22-2069 Document: 21 Page: 453 Filed: 09/12/2023

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00195
Patent 10,376,190

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgment – Final Written Decision (Paper 32) entered on May 25, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered June 3, 2021 (Paper 7). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1-14 and 16-30 of U.S. Patent 10,376,190 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2021-00195 involving Patent 10,376,190.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, to the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 27, 2022

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Jarom D. Kesler (Reg. No. 57,046)
Joseph R. Re (Reg. No. 31,291)
Stephen W. Larson (Reg. No. 69,133)
Jacob L. Peterson (Reg. No. 65,096)

Attorneys for Patent Owner
Masimo Corporation

Filed July 27, 2022

On behalf of:
Patent Owner Masimo Corporation
By: Jarom D. Kesler (Reg. No. 57,046)
Joseph R. Re (Reg. No. 31,291)
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.

Petitioner,

v.

MASIMO CORPORATION,

Patent Owner.

IPR2021-00208
Patent 10,258,266

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgment – Final Written Decision (Paper 32) entered on June 1, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered June 3, 2021 (Paper 7). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1-6, 8-16, 18 and 19 of U.S. Patent 10,258,266 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2021-00208 involving Patent 10,258,266.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, to the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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ATTACHMENT A

Case: 22-2069 Document: 16 Page: 4 Filed: 09/06/2022

Filed July 27, 2022

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00209
Patent 10,376,191

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgment – Final Written Decision (Paper 32) entered on May 25, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered June 3, 2021 (Paper 7). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1-6, 8-16, 18 and 19 of U.S. Patent 10,376,191 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2021-00209 involving Patent 10,376,191.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, to the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 27, 2022

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Attorneys for Patent Owner
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ATTACHMENT A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Poeze, et al.	
U.S. Patent No.:	10,299,708	Attorney Docket No.: 50095-0009IP1
Issue Date:	May 28, 2019	
Appl. Serial No.:	16/261,366	
Filing Date:	Jan. 29, 2019	
Title:	MULTI-STREAM DATA COLLECTION SYSTEM FOR NONINVASIVE MEASUREMENT OF BLOOD CONSTITUENTS	

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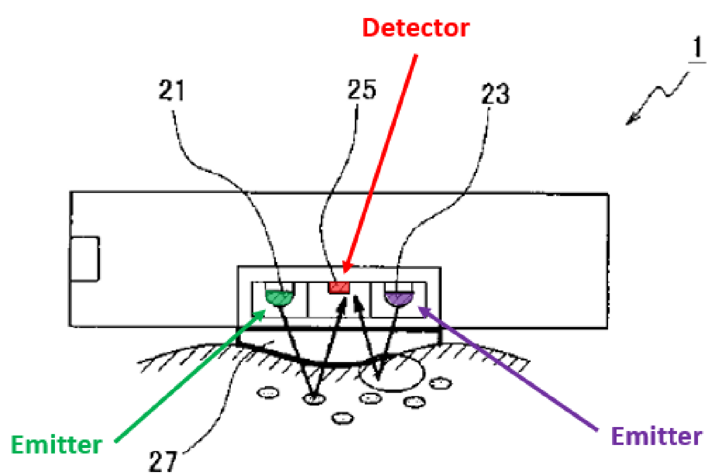
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

<u>PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 10,299,708 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42</u>

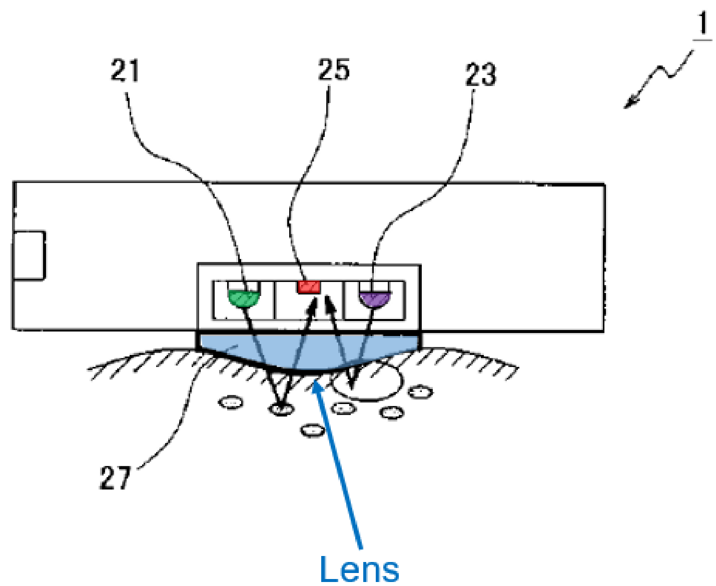
Referring to FIG. 2 below, Inokawa senses pulse by using a photodiode detector 25 (shown in red) to receive "light reflected off of the body (i.e. change in the amount of hemoglobin in the capillary artery)." APPLE-1008, [0058]. Inokawa teaches that "sensor-side light-emitting means of various kinds, such as an infrared LED or a green LED" can be used and that "work can be divided between" them as needed. APPLE-1008, [0014]. For example, green light from LED 21 (shown in green) can be used to sense the pulse while infrared light from LED 23 (shown in purple) can be used to sense body motion. APPLE-1008, [0058]-[0059] .



APPLE-1008, FIG. 2; APPLE-1003, ¶60.

Inokawa further teaches that a lens 27 can be "placed on the surface of the sensor-side light-emitting means" to thereby "make[] it possible to increase the light-gathering ability of the LED as well as to protect the LED or PD." APPLE-1008, [0015], [0058]. This structure corresponds to the light permeable cover

comprising a protrusion as recited in claim 1 of the ’708 patent. APPLE-1003, ¶61.



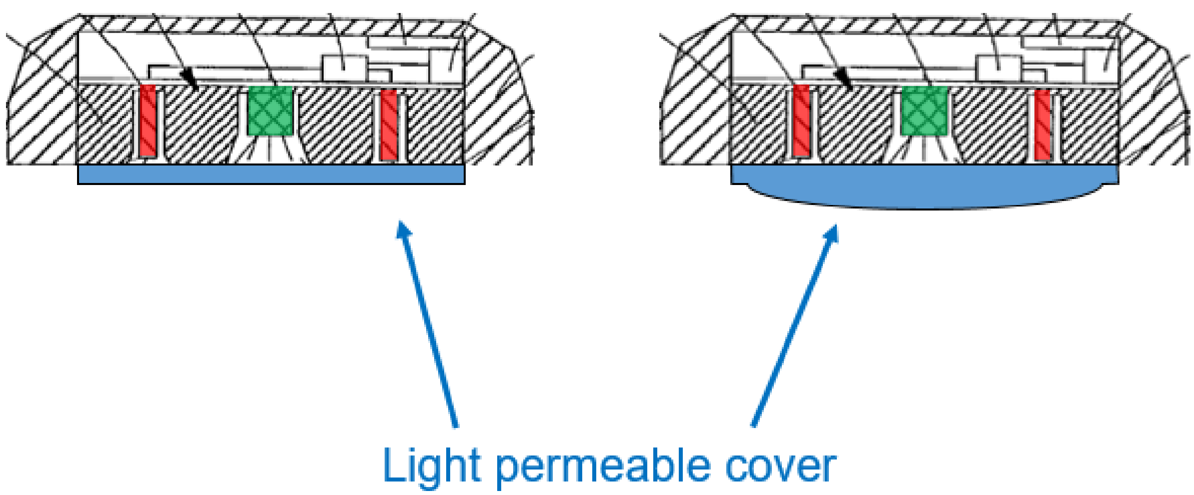
APPLE-1008, FIG. 2; APPLE-1003, ¶¶62-63.

3. Combination of Aizawa and Inokawa

A POSITA would have been motivated to combine Aizawa and Inokawa (“Aizawa-Inokawa”) to obtain additional benefits. APPLE-1003, ¶¶82-89. Beyond Aizawa’s disclosure that its light permeable cover is an acrylic transparent plate that helps improve “detection efficiency,” Aizawa does not provide much other detail, for instance regarding its shape. APPLE-1006, [0030]. A POSITA would have realized, however, that the plate could be given a shape to achieve Aizawa’s objective of improving detection efficiency and, further, would have known

would lead to an improved signal-to-noise ratio (and more reliable pulse detection). APPLE-1003, ¶¶86-87. The lens of Inokawa would provide precisely such a benefit to Aizawa's device by refracting/concentrating the incoming light signals reflected by the blood. *Id.*

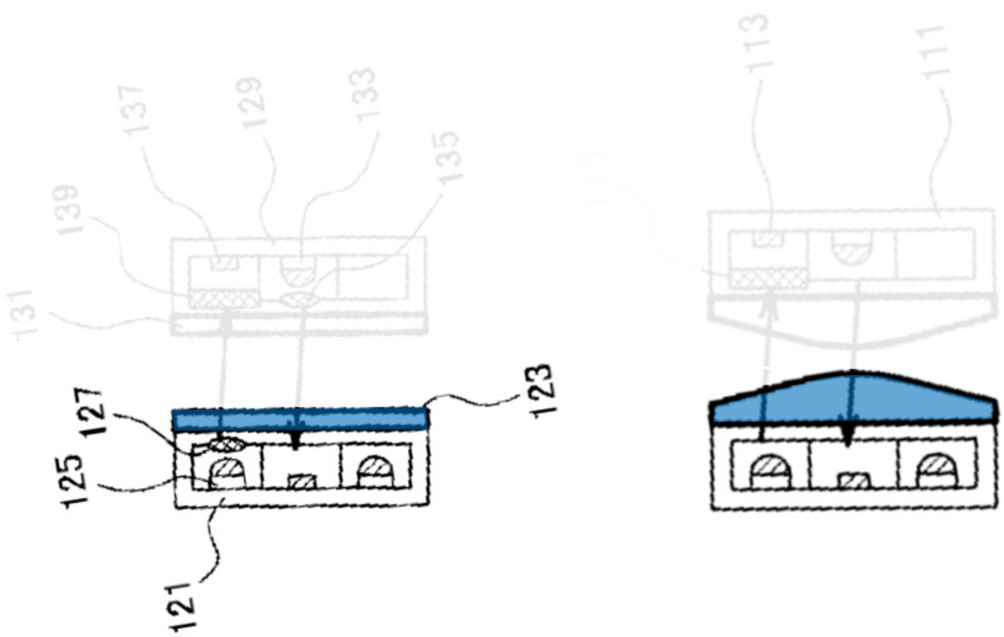
As illustrated below, the device resulting from the obvious combination of Aizawa and Inokawa would have replaced the flat cover (left) with a curved one as per Inokawa (right) to "increase the light-gathering ability." APPLE-1008, [0015]; APPLE-1003, ¶87.



APPLE-1006, FIG. 1(b); APPLE-1003, ¶87.

A POSITA would have understood how to implement Inokawa's lens cover in Aizawa's device with a reasonable expectation of success, stemming from the significant overlap across the references in their teaching. APPLE-1003, ¶88. For

example, as illustrated below, Inokawa teaches that its cover may be either flat (left) such that "the surface is less prone to scratches," APPLE-1008 at [0106], or in the form of a lens (right) to "increase the light-gathering ability of the LED." *Id.* at [0015].



APPLE-1008, FIG. 17 (left), FIG. 16 (right); APPLE-1003, ¶88. A POSITA would have further recognized that the transparent acrylic material used to make Aizawa's plate can be readily formed into a lens as in Inokawa. APPLE-1003, ¶89 (citing to APPLE-1009 at 3:46-51, FIG. 1, APPLE-1023, FIG. 6, [0022], [0032], [0035]). Thus, a POSITA making the design choice to prioritize improved light collection efficiency over reduced susceptibility to scratches could have readily modified Aizawa's cover to have a lens as per Inokawa. APPLE-1003, ¶89.

The above-described modification would require only routine knowledge of

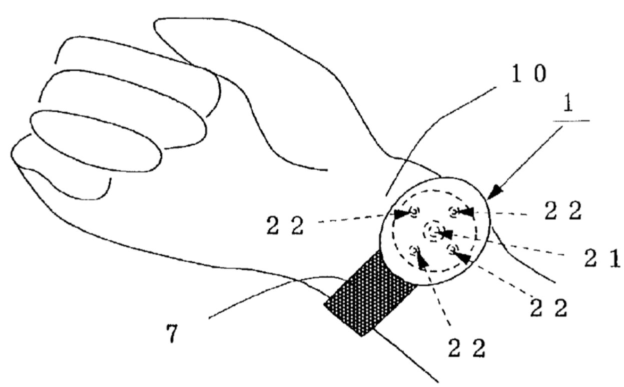
sensor design and assembly, which were well within the skill of a POSITA prior to the Critical Date. APPLE-1003, ¶89. Thus, to achieve Aizawa's and Inokawa's shared goal of improving light collection efficiency, a POSITA would have been motivated to modify Aizawa's light permeable cover to have a lens as per Inokawa with a reasonable expectation of success. APPLE-1003, ¶¶84-89.

4. Analysis

Claim 1
[1pre]: "A noninvasive optical physiological sensing system comprising:"

Aizawa discloses a sensing system that includes a pulse sensor designed to "detect[] the pulse wave of a subject from light reflected from a red corpuscle in the artery of a wrist of the subject by irradiating the artery of the wrist[.]" APPLE-1006, [0002]; APPLE-1003, ¶73. As shown below, Aizawa's sensor is designed to be worn on the wrist:

FIG. 2



UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE, INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

Case IPR2021-00193
Patent 10,299,708

PETITIONER'S EXHIBIT LIST

EXHIBITS

APPLE-1001	U.S. Patent No. 10,299,708 to Poeze, et al. ("the '708 patent")
APPLE-1002	Excerpts from the Prosecution History of the '708 patent ("the Prosecution History")
APPLE-1003	Declaration of Dr. Thomas W. Kenny
APPLE-1004	Curriculum Vitae of Dr. Thomas W. Kenny
APPLE-1005	*Masimo Corporation, et al. v. Apple Inc.,* Complaint, Civil Action No. 8:20-cv-00048 (C.D. Cal.)
APPLE-1006	U.S. Pub. No. 2002/0188210 ("Aizawa")
APPLE-1007	JP 2006-296564 ("Inokawa")
APPLE-1008	Certified English Translation of Inokawa and Translator's Declaration
APPLE-1009	U.S. Pat. No. 7,088,040 ("Ducharme")
APPLE-1010	U.S. Pat. No. 8,177,720 ("Nanba")
APPLE-1011	RESERVED
APPLE-1012	U.S. Pat. No. 6,853,304 ("Reisman")
APPLE-1013	U.S. Pub. No. 2004/0220738 ("Nissila")
APPLE-1014	U.S. Pub. No. 2001/0056243 ("Ohsaki")
APPLE-1015	"Design and Evaluation of a New Reflectance Pulse Oximeter Sensor," Y. Mendelson, et al.; Worcester Polytechnic Institute, Biomedical Engineering Program, Worcester, MA 01609; Association for the Advancement of Medical Instrumentation, vol. 22, No. 4, 1988; pp. 167-173 ("Mendelson-1988")
APPLE-1016	"A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Y. Mendelson, et al.; Proceedings of the 28th IEEE EMBS Annual International Conference, 2006; pp. 912-915 ("Mendelson-2006")
APPLE-1017	Excerpt from Merriam-Webster Dictionary

APPLE-1018	"Acrylic: Strong, stiff, clear plastic available in a variety of brilliant colors," available at https://www.curbellplastics.com/Research-Solutions/Materials/Acrylic
APPLE-1019	U.S. Pat. No. 7,031,728 ("Beyer")
APPLE-1020	U.S. Pat. No. 7,092,735 ("Osann, Jr.")
APPLE-1021	U.S. Pat. No. 6,415,166 ("Van Hoy")
APPLE-1022	QuickSpecs; HP iPAQ Pocket PC h4150 Series
APPLE-1023	U.S. Pat. App. Pub. No. 2007/0145255 ("Nishikawa")
APPLE-1024	"Measurement Site and Photodetector Size Considerations in Optimizing Power Consumption of a Wearable Reflectance Pulse Oximeter," Y. Mendelson, et al.; Proceedings of the 25th IEEE EMBS Annual International Conference, 2003; pp. 3016-3019 ("Mendelson-2003")
APPLE-1025	U.S. Pat. No. 6,801,799 ("Mendelson-'799")
APPLE-1026	Declaration of Jacob Munford
APPLE-1027	U.S. Pub. No. 2007/0093786 ("Goldsmith")
APPLE-1028	U.S. Pub. No. 2004/0138568 ("Lo")
APPLE-1029	Wikipedia: The Free Encyclopedia, "Universal asynchronous receiver-transmitter" at https://en.wikipedia.org/wiki/Universal_asynchronous_receiver-transmitter, last accessed 08/27/2020
APPLE_1030	U.S. Pub. No. 2008/0242958 to Al-Ali et al. ("Al-Ali")
APPLE-1031 to 1036	RESERVED
APPLE-1037	*Masimo Corporation, et al. v. Apple Inc.*, Second Amended Complaint, Civil Action No. 8:20-cv-00048 (C.D. Cal.) (Redacted)
APPLE-1038	U.S. Patent No. 8,577,431 to Lamego et al. ("CIP Patent")
APPLE-1039	Order Re Motion to Stay in *Masimo Corporation et al. v. Apple Inc.*, Case 8:20-cv-00048-JVS-JDE, October 13, 2020

Trials@uspto.gov
571-272-7822

Paper No. 29
Entered: April 5, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00193 (Patent 10,299,708 B1)
IPR2021-00195 (Patent 10,376,190 B1)
IPR2021-00208 (Patent 10,258,266 B1)
IPR2021-00209 (Patent 10,376,191 B1)

Record of Oral Hearing
Held: March 15, 2022

Before JOSIAH C. COCKS, ROBERT L. KINDER, and
AMANDA F. WIEKER, *Administrative Patent Judges.*

Petitioner also argues that a protrusion would increase adhesion. First of all, the only patent that discusses adhesion states that it's best to use a flat plate. That is Aizawa. Aizawa specifically says that plate increases comfort because the wrist is not pressed hard allowing it to be worn longer which is one of the main objectives of Aizawa.

Ohsaki and Inokawa say nothing of adhesion. Ohsaki discusses slippage during movement. Precautions throughout the disclosure that a bump can and will cause slippage during movement on all but specific configuration on the backside of the wrist. Both experts provided testimony supporting this. For example, at Exhibit 2008, page 156, line 18 through 158 line 20, that's Dr. Kenny. At Exhibit 2004, paragraph 83, that's Dr. Madisetti.

Further, adding Ohsaki's bump to Aizawa's sensor would cause an uncomfortable protrusion that would defeat one of the purposes of Aizawa. Similarly, Mendelson 1988 teaches the use of a forehead sensor. There is no evidence that a protrusion on the forehead would prevent slippage. Rather, as you can imagine, putting a protrusion on a forehead sensor would be incredibly uncomfortable and would increase slippage during movement given the structure of the forehead.

Second, again, if Petitioner is arguing the point is to create a system to dig in, then Petitioner hasn't shown why a person of skill in the art wouldn't again end up with other combinations with multiple

rate. Again, in Aizawa it talks about slippage. It's really about trying to prevent motion issues when measuring pulse rate. Dr. Kenny admits Aizawa identifies no problem with its wireless transmission and Dr. Kenny admits Aizawa's goal is real-time measuring. Petitioner ignores this teaching.

Key Teaching No. 6 of Aizawa. Aizawa addresses motion load through having detectors always over an artery on the wrist and computing the motion of load. As I mentioned before, Aizawa is really all about preventing motion. Aizawa discloses and teaches a sensor that looks for the artery itself, discloses a specific position, palm side of the wrist, with a transparent acrylic plate to improve adhesion and detection efficiency and provide user comfort. But multiple detectors symmetrically spaced around so at least one is always close to at least one artery, even if the sensor gets dislocated. It uses one LED and looks for at least one of the multiple photodiodes to have a signal.

Let's move on to Mendelson-1988. That's our Patent Owner Slide 13. First, Mendelson-1988 is a pulse oximeter sensor, not just a pulse rate sensor. SPO 2, or pulse oximetry, is much more difficult to measure than respiration rate alone. Respiration rate merely looks for some kind of pulsation, whereas pulse oximetry has to now look at a color change which is much more difficult.

Mendelson-1988 is also illustrated using a single -- using a flat surface sensor with optically clear epoxy encapsulant creating a flat contacting surface. That makes sense. It's a forehead sensor. A

protrusion would make the sensor very uncomfortable and would be unable to provide intimate contact. Again, for the forehead consistent with Mendelson-799, for example, with an eye to work fetal oximetry during delivery, explains again that forearm, chest, and back prove difficult due to relatively small photoplethysmograph signals leading to practical problems. It teaches that any low blood density areas are bad. That's page 2, column left middle.

This is straight out of Mendelson-1988 - practically the major limitation and reflection pulse oximetry is the comparatively low level photoplethysmograms typically reported from low density vascular areas of the skin. The feasibility of reflection pulse oximetry, therefore, is essentially dependent on the ability to design a sensor that can detect sufficiently strong reflection photoplethysmographic signals from various locations on the body. At Mendelson-2003 it explains that the wrist is one of these low-density sections. That's Exhibit 1024, page 1 and 3 through 4.

So moving on to Ohsaki, Slide 14. The problem here is a reliable detection of pulse on the wrist. Petitioner ignores multiple key teachings from Ohsaki, some of which we have already covered. Most importantly, first it's lacking any teaching or disclosure of a convex surface over multiple detectors.

Indeed, imagine if you put this Mendelson-1988 sensor on the forehead in a soldier's helmet. A bump on the thin skin of your forehead in a helmet, or headband, to press that bump onto your forehead, I don't think we need anyone to tell us that would be painful

and would not have good contact surface. More importantly, in view of the teachings of Mendelson-799, for example, a positive would have displaced -- would also displace the superficial blood that Mendelson says creates a problem. Aizawa also says use symmetrical arrangements and a transparent flat plate covering the detectors to get improved detection efficiency and adhesion. It could be counterproductive to add some larger field of view from a lens.

Another key teaching from Ohsaki that leads away from a palm side wrist. Ohsaki teaches it will slip off the palm side. As I mentioned before, Figure 4(a) and 4(b) of Ohsaki discussed at paragraph 25 are comparing flat to convex on the backside of the wrist and that was agreed to by both experts. You can find that at Exhibit 2008, page 156, line 18 through page 157, line 4. Dr. Madisetti explains that at Exhibit 2004, pages 82 through 85.

So moving on to Inokawa, Patent Owner Slide 17. Inokawa is a pulse wave recording device. It's not a real-time monitor. It's a data logger for later download. It's also not a pulse oximeter which would require at least red and infrared. The problem stated as being address are problems with mechanically connected data recording systems such as via cable. This is trying to replace a hardwired cable involving contact failure or deterioration that causes lack of reliability when downloading information from the wrist-worn data collection device to the base station.

The solution is using a matched LED photodiode light-based two-way communication system in the sensor and base station to

Filed July 27, 2022

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2021-00193
Patent 10,299,708

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgment – Final Written Decision (Paper 30) entered on June 1, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered June 3, 2021 (Paper 7). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1-29 of U.S. Patent 10,299,708 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2021-00193 involving Patent 10,299,708.

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Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 27, 2022

By: /Jarom Kesler/
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SCORE Placeholder Sheet for IFW Content

Application Number: 16261366 Document Date: 01/29/2019

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

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Form Revision Date: August 26, 2013

a light permeable cover arranged above at least a portion of the platform ~~housing~~, the light permeable cover protruding ~~from the circular~~ above the raised wall ~~of the platform~~.

2. The following is an examiner's statement of reasons for allowance: The Terminal Disclaimer of application Nos. 16/212,440, 16/212,537, and 16/261,326 is approved on 03/25/2019 to resolve proposed double patenting rejections alleged by the Examiner and discussed during the phone interview.

Chaiken et al. (USPN 6,223,063 – applicant cited) teaches a noninvasive optical physiological sensing system (Figs. 1-2) comprises a protruding light permeable cover (elements 110 with four protruding lenses 150, Fig. 1) and four detectors arranged in a grid pattern such that a first detector and a second detector are arranged across from each other on opposite sides of a central point along a first axis, and a third detector and a fourth detector are arranged across from each other on opposite sides of the central point along a second axis which is perpendicular to the first axis (elements 160 disposed on base 140, Fig. 1). Wong et al. (USPN 5,601,079) teaches a noninvasive optical physiological sensing system (Figs. 4A-4B, 6A-6B, and 8A-8B) comprises a circular housing with raised edge/wall (element 611, Fig. 4B), a base PCB (element 613, Fig. 4B), a light permeable cover (element 64, Fig. 4), three detectors (elements 68, 68 and 610, Fig. 4) mounted on the center portion of the housing (Figs. 4A-4B). O'Neil et al. (USPN 7,113,815) teaches a noninvasive optical physiological sensing system (Fig. 1) comprises a circular housing (element 6, Fig. 1), a protruding light permeable cover (element 4, Fig. 1), a detector (element 7, Fig. 1). However, the prior

art of record does not teach or suggest “a housing including a raised edge portion extending from and enclosing at least a portion of the planar surface; at least four detectors arranged on the planar surface of the circular platform and within the housing; the housing including a protruding light permeable cover” and “a platform forming a base of a housing, the housing including a raised wall protruding from the platform; at least four detectors arranged on the platform and within the raised wall; a light permeable cover arranged above at least a portion of the platform housing, the light permeable cover protruding above the raised wall”, in combination with the other claimed elements/ steps.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHU CHUAN LIU whose telephone number is (571)270-5507. The examiner can normally be reached on M-Th (8am-6pm).

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Jacqueline Cheng can be reached on (571) 272-5596. The fax phone

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Poeze et al.	
U.S. Patent No.:	10,299,708	Attorney Docket No.: 50095-00009IP1
Issue Date:	May 28, 2019	
Appl. Serial No.:	16/261,366	
Filing Date:	May 10, 2019	
Title:	MULTI-STREAM DATA COLLECTION SYSTEM FOR NONINVASIVE MEASUREMENT OF BLOOD CONSTITUENTS	

DECLARATION OF DR. THOMAS W. KENNY

Declaration

I declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable under Section 1001 of Title 18 of the United States Code.

By: ______________________________

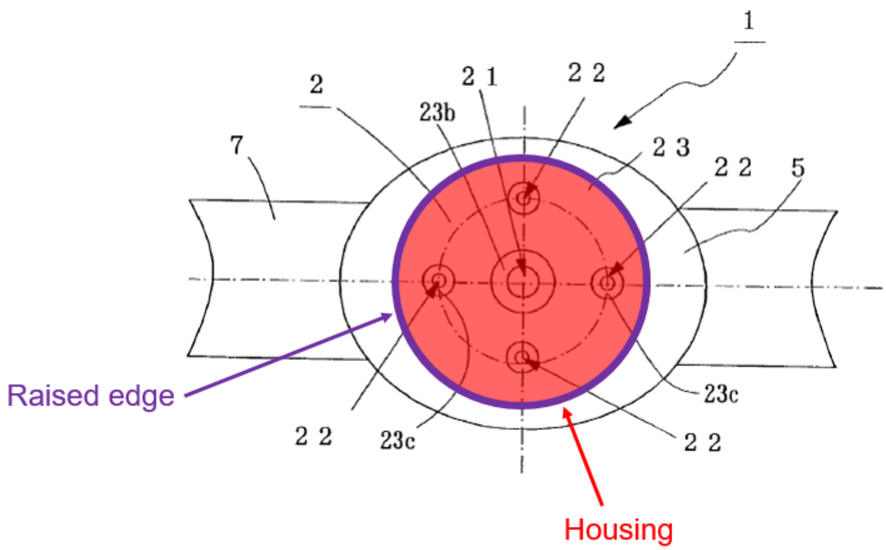
Thomas W. Kenny, Ph.D.

I. QUALIFICATIONS AND BACKGROUND INFORMATION

1. My education and experience are described more fully in the attached curriculum vitae (APPLE-1004). For ease of reference, I have highlighted certain information below.

2. My academic and professional background is in Physics, Mechanical Engineering, Sensing, and Robotics, with a research specialization focused on microfabricated physical sensors, and I have been working in those fields since the completion of my Ph.D. more than 30 years ago. The details of my background and education and a listing of all publications I have authored in the past 35 years are provided in my curriculum vitae, attached as Exhibit A. Below I provide a short summary of my education and experience which I believe to be most pertinent to the opinions that I express here.

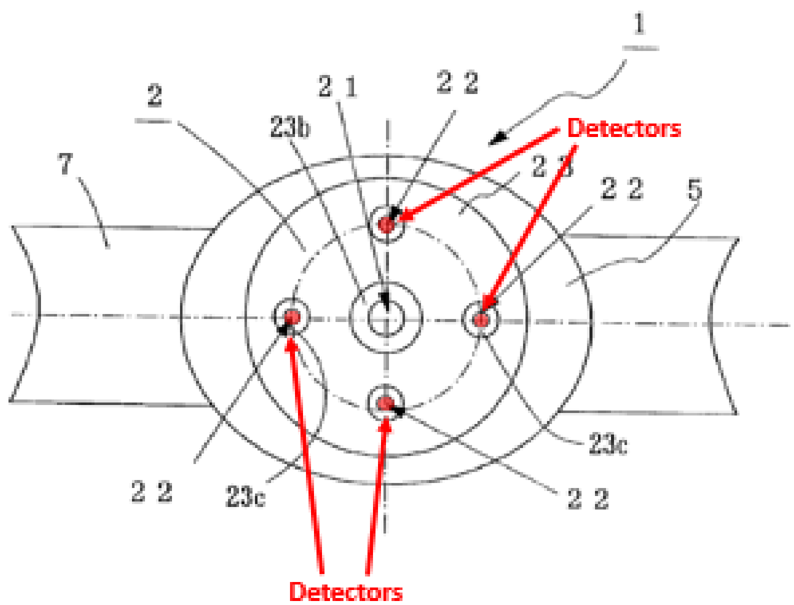
Aizawa's holder provides a raised edge (shown in purple) that extends from the planar surface and encloses at least a portion of the planar surface:



APPLE-1006, FIG. 1(a)

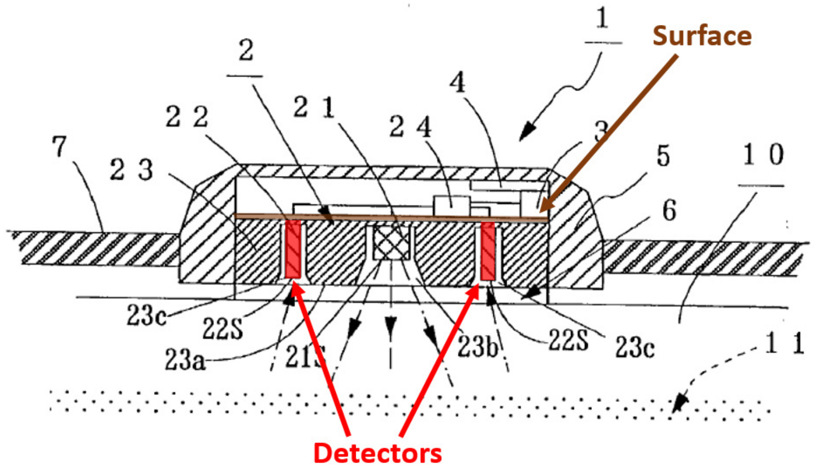
[1c] at least four detectors arranged on the planar surface of the platform and within the housing, wherein the at least four detectors are arranged in a grid pattern such that a first detector and a second detector are arranged across from each other on opposite sides of a central point along a first axis, and a third detector and a fourth detector are arranged across from each other on opposite sides of the central point along a second axis which is perpendicular to the first axis; and

78. As illustrated below, Aizawa teaches "four photodetectors 22 disposed around the light emitting diode 21 symmetrically on a circle concentric to the light emitting diode 21." APPLE-1006, [0029], [0024], [0032]. These four detectors are, as seen below, spaced apart from each other by being arranged symmetrically in a circular pattern. *Id.*



APPLE-1006, FIG. 1(a)

79. Moreover, these four detectors are arranged *on the surface* of the housing as identified above for element [1c]. In particular, as shown below, the detectors are positioned within the holder 23 and are further connected, through the surface (shown in brown), to a drive circuit 24 on the other side of the housing. *Id.*, [0023]. A POSITA would have understood that circuit 24 and other wires/electronics are connected to the detectors *through* the surface, and, therefore, the surface provides physical support to the detectors. *Id.* Indeed, it is well-known to mount electronic components, such as photodiodes and LEDs, to a flat surface such as a ceramic substrate or a circuit board to provide both mechanical and electrical coupling. [0017], FIG. 2; APPLE-1015, 168, FIG. 2B.

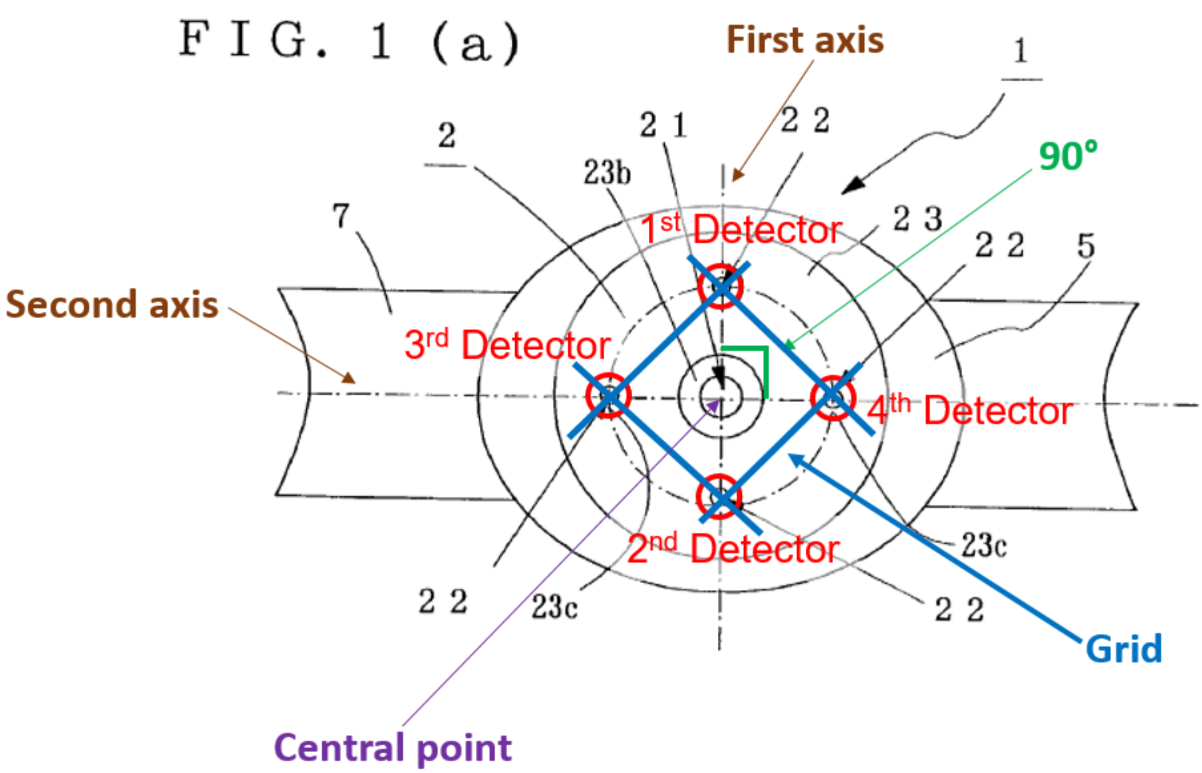


APPLE-1006, FIG. 1(b)

80. Regarding the signals that are output by Aizawa's detectors, Aizawa's photodetectors 22 are designed to detect light that is "reflected by a red corpuscle running through the artery 11 of the wrist 10 ... so as to detect a pulse wave." APPLE-1006, [0027]. Aizawa subsequently "detect[s] a pulse wave by amplifying the outputs of the photodetectors 22." *Id.*, [0023]. For example, Aizawa's detectors output "waveform of a pulse wave," and this output is amplified and converted into a digital signal to compute the pulse rate. *Id.*, [0028]. Thus, the detectors of Aizawa "output one or more signals responsive to light from the one or more light emitters attenuated by body tissue" and this signal is further "indicative of a physiological parameter of the wearer."

81. Moreover, as illustrated below, the detectors are arranged in a grid pattern relative to a central point, and the first/second axes, for example as identified

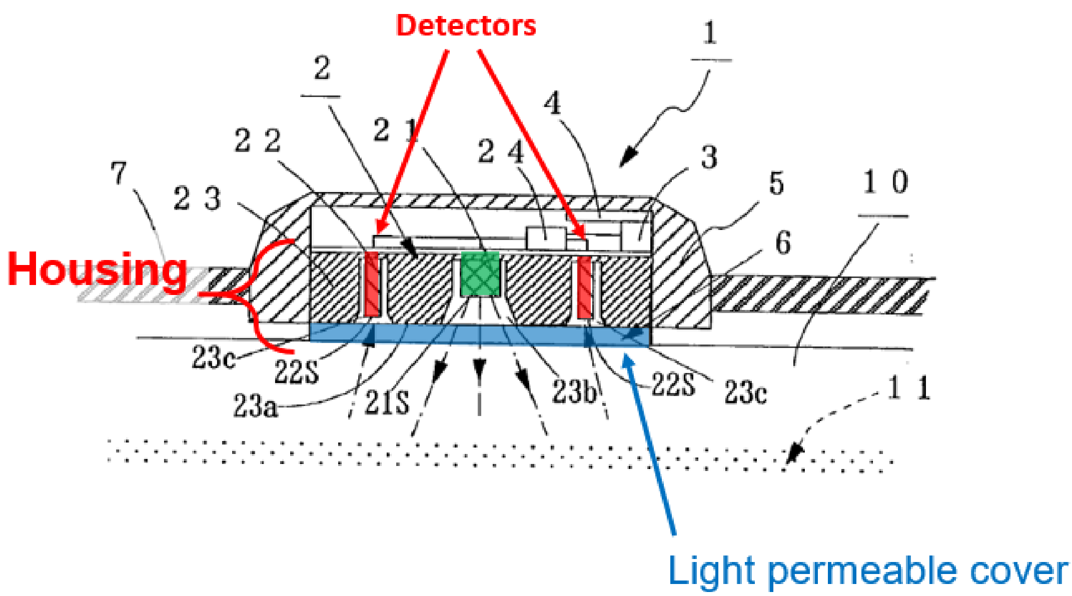
below, are perpendicular to each other. Moreover, because of the high symmetry (rotations and reflections) of the arrangement of four detectors with respect to the central point, there are many grids that can be drawn which would meet the limitations of this claim element. The illustration provided is just one of many possible grids. This symmetry provides many obvious and useful benefits, including reduced sensitivity to the location of the device relative to the anatomy, manufacturing convenience, assembly convenience, and likely customer appreciation of the aesthetics associated with symmetry that come with the overall circular shape and preferred styles for wrist-worn objects.



APPLE-1006, FIG. 1(a)

[1d] the housing including a protruding light permeable cover.

82. As shown below, Aizawa teaches a light permeable cover in the form of an acrylic transparent plate 6 (colored blue) that is mounted at the detection face 23a over at least a portion of the housing to cover the at least four detectors (colored red). APPLE-1006, [0023].



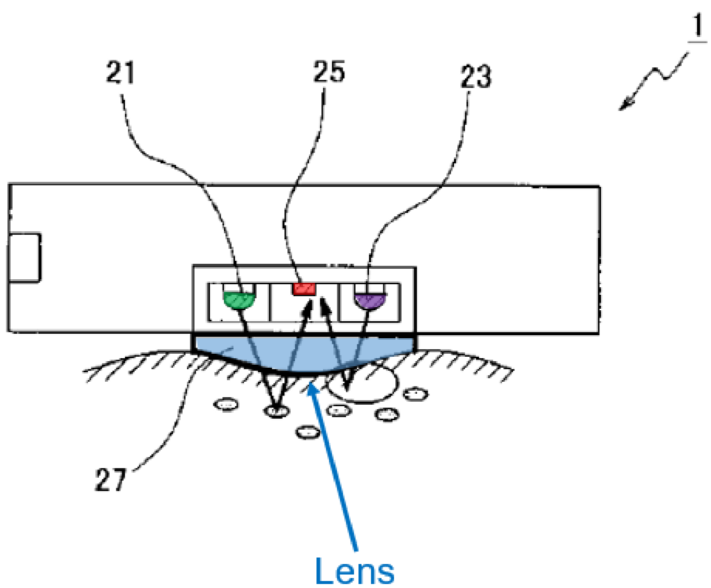
APPLE-1006, FIG. 1(b)

83. Because the light permeable cover of Aizawa, as seen above, protrudes from the rest of the housing and is designed to be pressed into the skin when worn, it is protruding—and is thus a protruding light permeable cover.

84. Moreover, to the extent Patent Owner argues that the cover of Aizawa is not protruding because it's flat, a POSITA would additionally have been motivated and known how to modify the flat shape of Aizawa's acrylic plate as needed to achieve a desired design objective. For example, Aizawa teaches that its light

permeable cover (*i.e.*, acrylic transparent plate) helps improve “detection efficiency” without providing additional details about how, for instance based on its shape or material properties, such an effect may be achieved. APPLE-1006, [0030]. But a POSITA would have recognized that the shape of Aizawa’s plate could be modified based on well-known and well-established techniques to help achieve Aizawa’s objective of improving detection efficiency. APPLE-1006, [0013], [0030], [0032]; APPLE-1009 at 3:46-51.

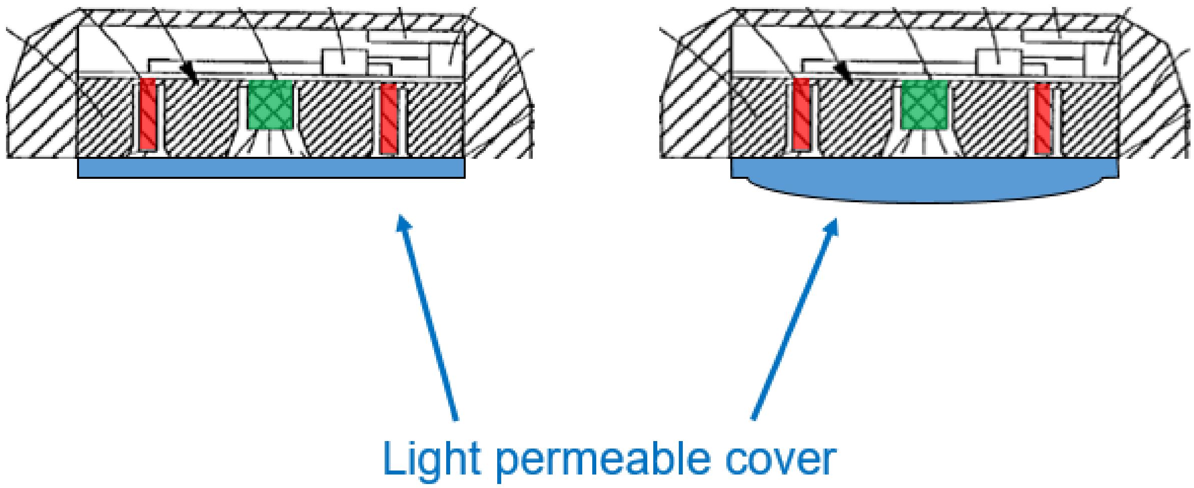
85. For instance, a POSITA would have looked to Inokawa to enhance light collection efficiency, specifically by modifying the light permeable cover of Aizawa to include a convex protrusion that acts as a lens, as per Inokawa. APPLE-1008, FIG. 2. As illustrated below, Inokawa teaches a side lens 27 (colored blue) that is positioned between a pulse sensor and the user’s skin. *Id.*



APPLE-1008, FIG. 2

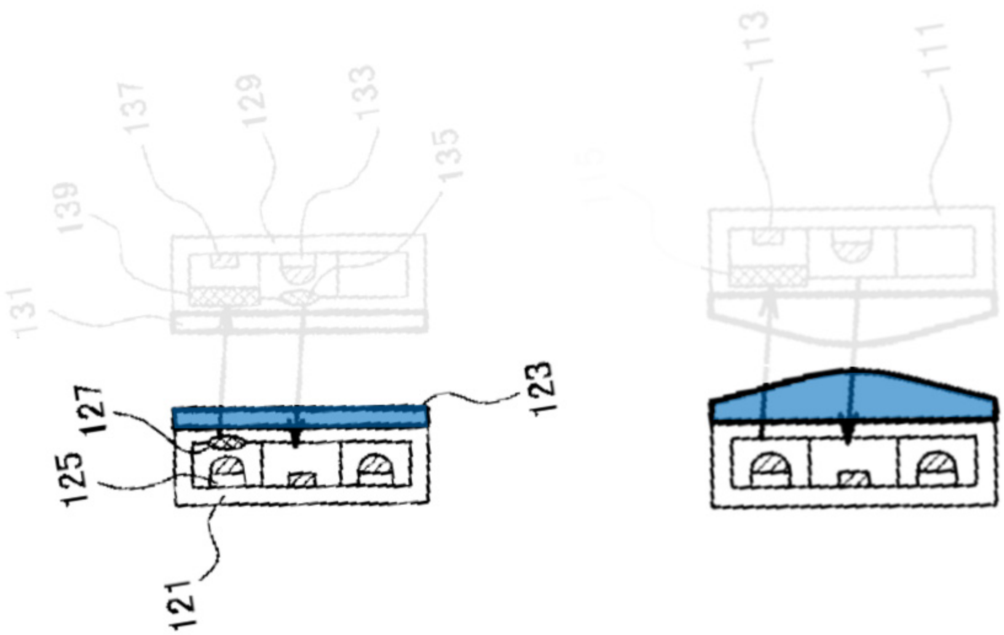
86. Inokawa teaches that the "lens makes it possible to increase the light-gathering ability of the LED." *Id.*, [0015]. Thus, a POSITA would have sought to incorporate a convex, lens structure as in Inokawa into Aizawa's acrylic plate to thereby increase light collection efficiency, in turn leading to an enhanced signal-to-noise ratio and ultimately more reliable pulse wave detection. The lens of Inokawa can provide this benefit by refracting and concentrating the light coming in through Aizawa's acrylic plate after being reflected by the blood. Incidentally, because the path of light is reversible, the light collection function of Inokawa's lens would work the same way regardless of whether light is emitted toward the center (and detected by a centrally located photodiode) or emitted away from the center (and detected by a peripherally located photodiode).

87. In more detail, a POSITA would have found it obvious to combine the teachings of Aizawa and Inokawa such that the flat cover (left) of Aizawa is modified to include a lens/protrusion (right) as per Inokawa in order to "increase the light-gathering ability." APPLE-1008, [0015]. Indeed, by positioning a lens above the optical components of Aizawa, as shown below, the modified cover will allow more light to be gathered and refracted toward the light receiving cavities of Aizawa, thereby further increasing the light-gathering ability of Aizawa beyond what is achieved through the tapered cavities. APPLE-1006, [0012], [0024].



APPLE-1006, FIG. 1(b)

88. A POSITA would have further understood *how* to incorporate the structure of Inokawa's cover into Aizawa's cover, and further would have expected such a modification to succeed given the high degree of overlap between the two references. For example, as shown below, Inokawa teaches that its light permeable cover can be flat (left) so that "the surface is less prone to scratches," or alternatively be in the form of a lens (right) to "increase the light-gathering ability of the LED." APPLE-1008, [0015], [0016]. That is, depending on the desired objective of the user (*e.g.*, less scratches or improved light-gathering), the shape of the cover can be readily modified. Moreover, by choosing the material of the protrusion to be scratch-resistant, such as glass, it would have been obvious for a POSITA to achieve both benefits at once.

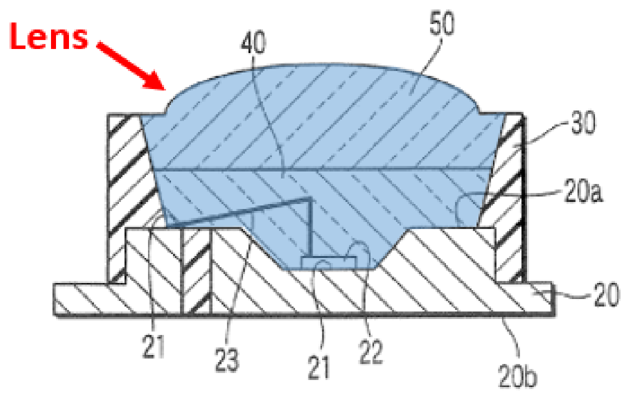


APPLE-1008, FIG. 17 (left), FIG. 16 (right)

89. A POSITA would have further recognized that the acrylic material used to make Aizawa's acrylic transparent plate 6 can be easily formed to include a lens. *See* APPLE-1009 at 3:46-51, FIG. 1; APPLE-1023, FIG. 6, [0022], [0032], [0035]. Indeed, many prior art references of this period, such as Nishikawa (shown below) demonstrate exactly how such a lens may be incorporated into a molded cover. APPLE-1023, FIG. 6, [0022], [0032], [0035]. In other words, a POSITA would have known that acrylic is a transparent material that can be readily transformed into various shapes, including a lens, as needed due to its easy molding properties. *Id.* Thus, a POSITA preferring improved light collection efficiency over reduced susceptibility to scratches could have been able to easily modify Aizawa's cover to include a lens structure as per Inokawa. *Id.* Indeed, only a routine knowledge of

sensor design and assembly, which were well within the skill of a POSITA, would be required to perform such modifications. Thus, to achieve the goal of improving light collection efficiency, which both Aizawa and Inokawa share, a POSITA would have been able to, with a reasonable expectation of success, modify Aizawa's light permeable cover to have a lens as taught by Inokawa.

FIG. 6

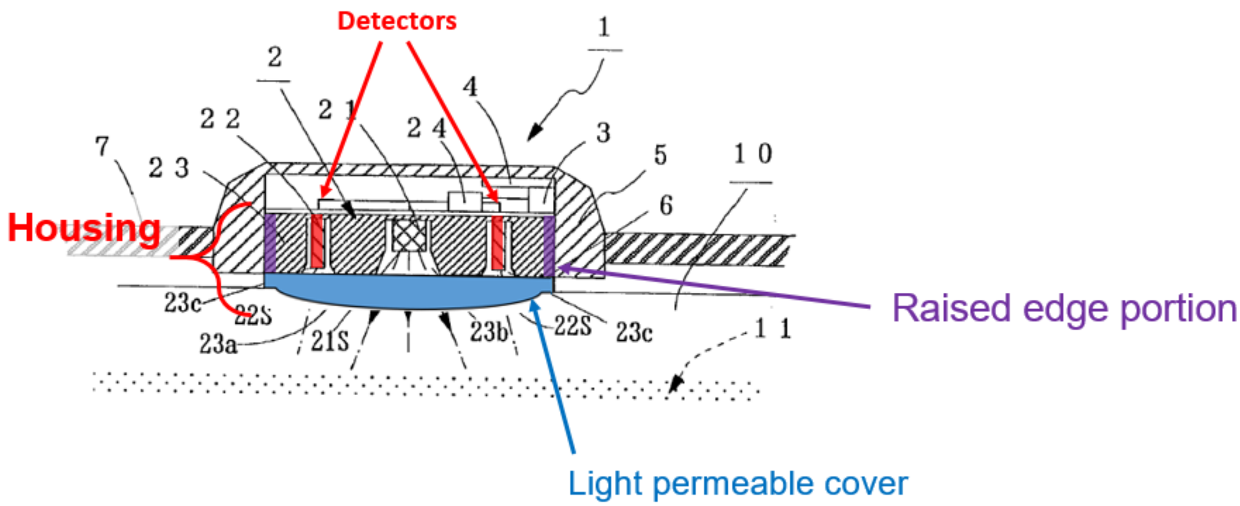


APPLE-1023, FIG. 6

B. Claim 2

[2] The noninvasive optical physiological sensing system of claim 1, wherein the protruding light permeable cover is joined to the housing along the raised edge portion of the housing, and wherein the protruding light permeable cover and the housing together hermetically seal the at least four detectors.

90. As explained above with respect to element [1d] and shown below, the Aizawa-Inokawa combination would have included a light permeable cover that covers the detectors and is attached to the housing, thereby enclosing them. APPLE-1006, [0023].



APPLE-1006, FIG 1(b)

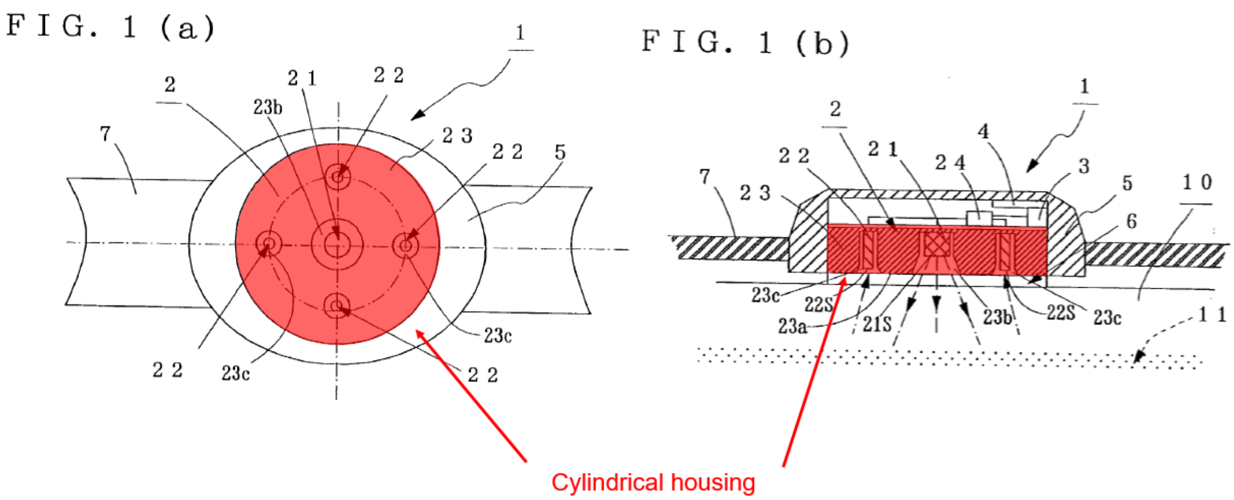
91. A POSITA would have also recognized that a wristwatch-like device, as in Aizawa and Inokawa, would be airtight and/or watertight such that it is hermetically sealed. For instance, it was well-known that wristwatch-type monitoring devices are hermetically sealed for improved convenience and functionality. *See* APPLE-1012, 5:11-20, 7:1-9; APPLE-1013, [0032]. This is especially true for body-worn devices because condensation, sweat, dust particles, environmental pollutants, and other undesirable elements may otherwise enter the housing and damage the sensitive internal electronics. *Id.* The fact that Aizawa's sensor is designed for "measuring . . . heart rate at the time of exercise" makes it even more crucial that the device be airtight. APPLE-1006, [0004]. Thus, a POSITA would have recognized or found it obvious that the light permeable cover of Aizawa-Inokawa would form an airtight or substantially airtight seal to enclose

the four detectors in a safe, well-protected environment that is safe from the elements.

C. Claim 3

[3] The noninvasive optical physiological sensing system of claim 2, wherein the housing is a cylindrical housing.

92. As explained above for [1b], the Aizawa-Inokawa combination includes a housing. Further, as indicated below in red, the housing portion has a cylindrical shape (and is thus a cylindrical housing):



APPLE-1006, FIGS. 1(a) and 1(b)

D. Claim 4

[4] The noninvasive optical physiological sensing system of claim 2, wherein the protruding light permeable cover comprises a convex lens.

93. As explained above with respect to [1d], the Aizawa-Inokawa combination would have included a light permeable cover with a lens-like protrusion. APPLE-

121. For reasons I discussed above with respect to element [15], herein incorporated by reference, this limitation is rendered obvious by the Aizawa-Inokawa combination.

U. Claim 27

[27] The noninvasive optical physiological sensing system of claim 26, wherein the noninvasive optical physiological sensing system is comprised as part of a mobile monitoring device.

122. Aizawa teaches that its "pulse rate detector 1" can be "attached to the wrist 10 with the belt 7 . . . thereby making it possible to carry it for a long time." APPLE-1006, [0026], [0023], [0031]. Accordingly, the detector of Aizawa (*i.e.*, noninvasive optical physiological measurement device) can become a part of a mobile monitoring device, which is carried around by the user in a comfortable manner to provide mobile monitoring of his/her physiological parameters (*i.e.*, pulse rate). APPLE-1006, [0026].

IX. GROUND 1B –Claims 1-4, 6-11, 13-15, 19-22, and 24-27 Are Rendered Obvious by Aizawa in view of Inokawa and Ohsaki

A. Claims 1-4, 6-11, 13-15, 19-22, and 24-27

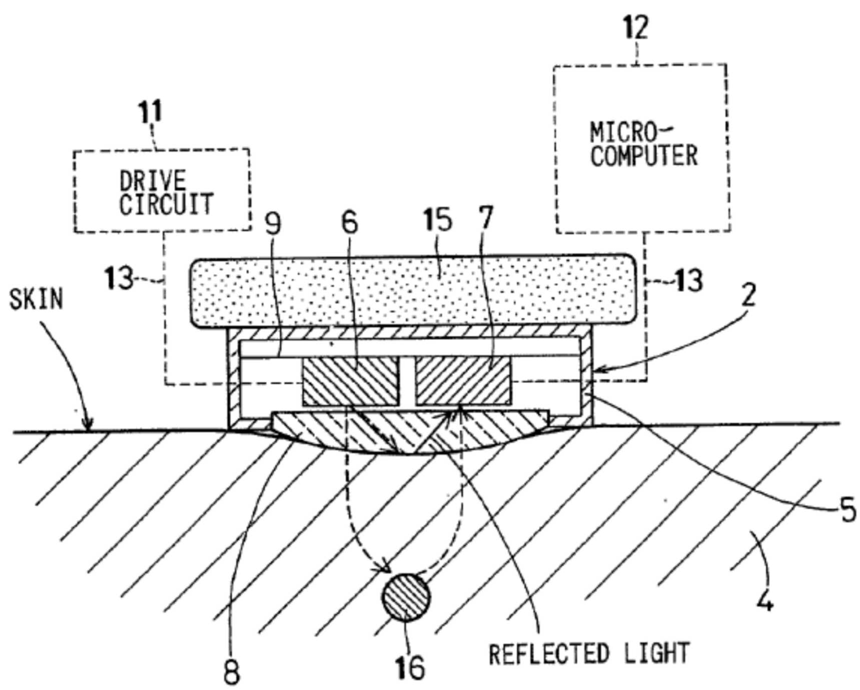
[1d] the housing including a protruding light permeable cover.

123. As I explained above in ¶¶ 82-89 with respect to element [1d] in Ground 1A, a POSITA would have been motivated to incorporate a lens-like protrusion of Inokawa into the cover of Aizawa to increase the light collection efficiency.

124. Ohsaki (APPLE-1014), which I briefly described above ¶¶ 64-65 provides an alternative/additional rationale for why a POSITA would have modified the flat shape of Aizawa's acrylic plate into a "light permeable cover comprising a protrusion" as per element [1d].

125. Among other things, Ohsaki teaches that adding a convex surface to its translucent board 8 (*i.e.*, light permeable cover) can help prevent the device from slipping on the tissue of the wearer compared to using a flat cover without such a protrusion. APPLE-1014, [0025].

FIG. 2



APPLE-1014, FIG. 2

126. Minimizing slippage between a user-worn sensor device and the tissue of the user was indeed a well-known objective in such devices. For example, Aizawa

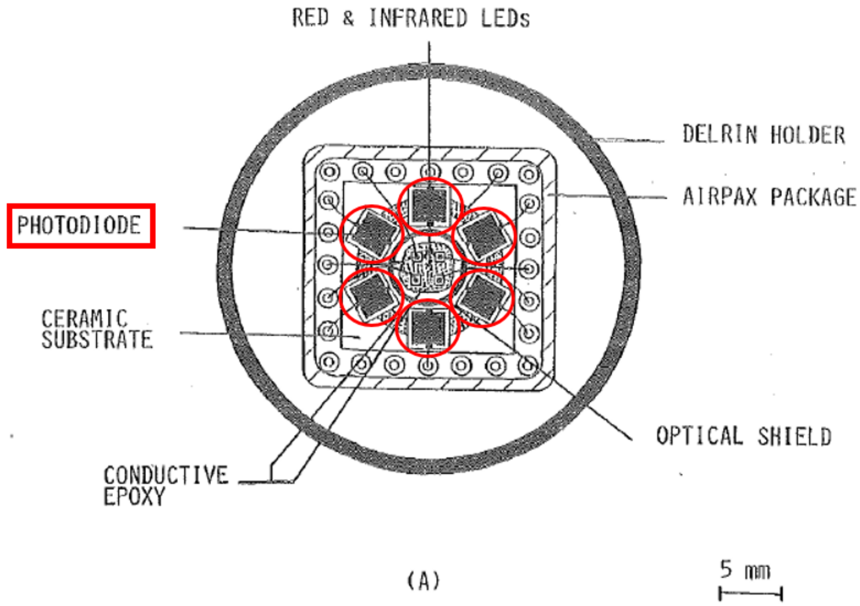
teaches using its acrylic transparent plate 6 (*i.e.*, light permeable cover) to improve "adhesion between the wrist 10 and the pulse rate detector 11." APPLE-1006, [0026], [0030]. While Aizawa doesn't discuss whether the shape of its acrylic plate could be modified to achieve this objective, a POSITA in possession of both Aizawa and Ohsaki would have recognized that Ohsaki's addition of a convex protrusion to its light permeable cover could be similarly implemented in Aizawa's device to help achieve the two references' shared goal of minimizing slippage. *Id.* In other words, a POSITA seeking to achieve improved adhesion between the detector and the skin, as expressly recognized in Aizawa, would have been motivated and readily able to modify Aizawa's acrylic plate to have a convex shape as in Ohsaki. This would have allowed Aizawa's sensor device to remain better adhered to the skin and thereby increase its light-collecting efficiency. APPLE-1006, [0026], [0030]; APPLE-1014, [0025]. Additionally, a POSITA would have appreciated that the lens/protrusion in the Aizawa-Inokawa combination would have provided a similar anti-slippage advantage due to the lens's convex shape, thereby providing an additional motivation for a POSITA to make the above-noted modification of Aizawa in view of Inokawa's lens.

127. The resulting Aizawa-Inokawa-Ohsaki combination satisfies all remaining elements of claims 1-9, 11, 13-15, 19-22, 24-27 in the same manner as previously described in Ground 1A, which is herein incorporated by reference.

166. Further, as seen above, a raised edge portion (circled in green) extends vertically upward from the planar surface of the ceramic substrate and encloses at least a portion of the planar surface.

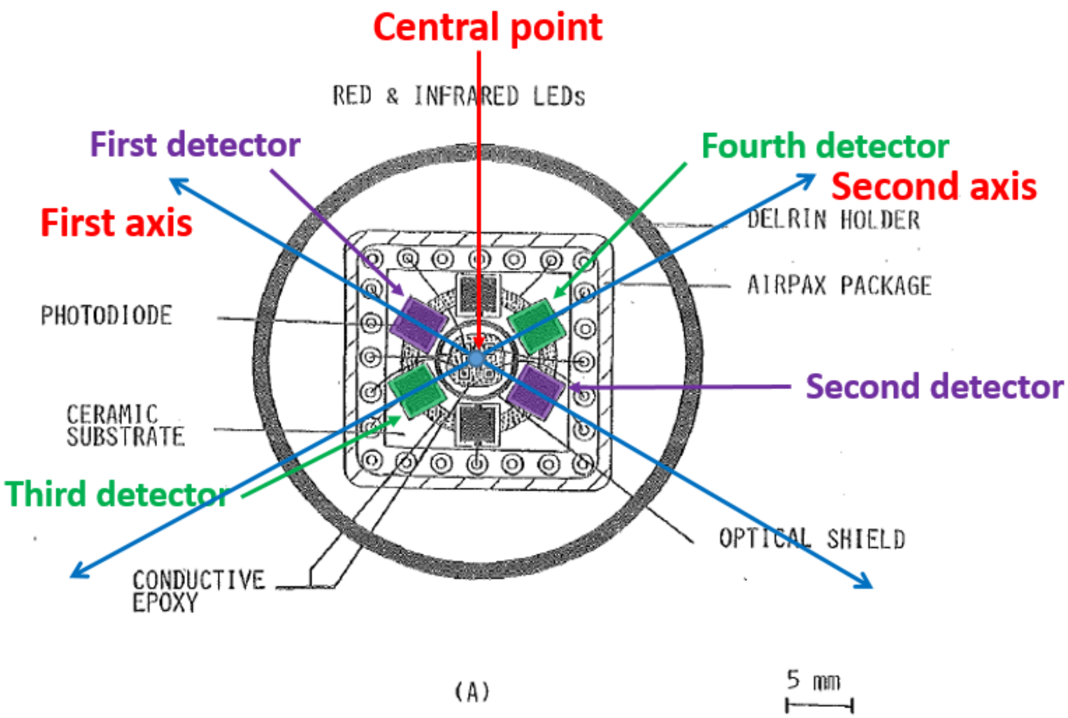
[1c] at least four detectors arranged on the planar surface of the platform and within the housing, wherein the at least four detectors are arranged in a grid pattern such that a first detector and a second detector are arranged across from each other on opposite sides of a central point along a first axis, and a third detector and a fourth detector are arranged across from each other on opposite sides of the central point along a second axis which is perpendicular to the first axis; and

167. Mendelson-1988 teaches “six silicon photodiodes ... arranged symmetrically in a hexagonal configuration,” as shown below, thus providing at least four detectors as claimed. APPLE-1015, 168. Output from the detectors are “current pulses ... which correspond to the red and infrared light intensities reflected from the skin” and are processed to respective photoplethysmographic waveforms. APPLE-1015, 169. Moreover, the detectors are arranged on the surface provided by the ceramic substrate. APPLE-1015, 168; FIG. 2(B).



APPLE-1015, FIG. 2(A)

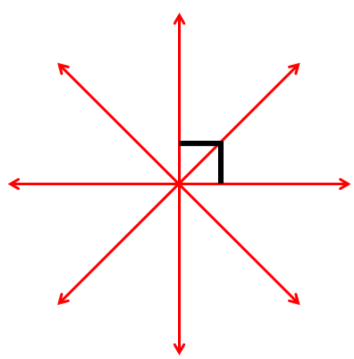
168. Further, as shown below, the detectors are arranged in a grid pattern relative to a central point, and the first/second axes, for example as identified below, are nearly perpendicular to each other. Moreover, because of the high symmetry (rotations and reflections) of the arrangement of four detectors with respect to the central point, there are many grids that can be drawn which would meet the limitations of this claim element. The illustration provided is just one of many possible grids. This symmetry provides many obvious and useful benefits, including reduced sensitivity to the location of the device relative to the anatomy, manufacturing convenience, and assembly convenience.

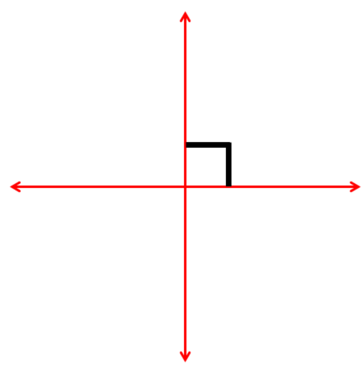


APPLE-1015, FIG. 2(A)

169. While the first and second axes as shown above form a cross pattern, they are not shown to be completely perpendicular to each other. Here, I note that Mendelson-1988 does not indicate that its system only works with six detectors. APPLE-1015, 168. In fact, Mendelson 1988 explains that "the total amount of backscattered light that can be detected by the reflectance sensor is diretly proportional to the number of photodetectors." *Id.* Accordingly, a POSITA would have recognized that different numbers of detectors may be readily chosen depending on the detection requirements of a particular system. For example, two more detetors may be added—to make 8 total detectors—by a POSITA that is seeking to achieve enhanced light detection capabilities since increasing the

number of detectors will increase the amount of light being collected. Similarly, a POSITA seeking to achieve reduced power consumption may remove two detectors to achieve 4 total detectors. In either case, with 8 or 4 detectors instead of 6, the resulting detector configuration in which the detectors remain equally spaced apart would result in perpendicular axes as claimed, as shown below.





170. In fact, other wearable physiological sensing devices during this period provide further support for arranging 4 or 8 photodetectors as contemplated above such that the alignment axes are pendicular. Aizawa, for exapmle, explictly teaches wearable pulse sensing devices that work with 8 and 4 detectors, as shown below. APPLE-1006, [0032].

FIG. 4 (a)

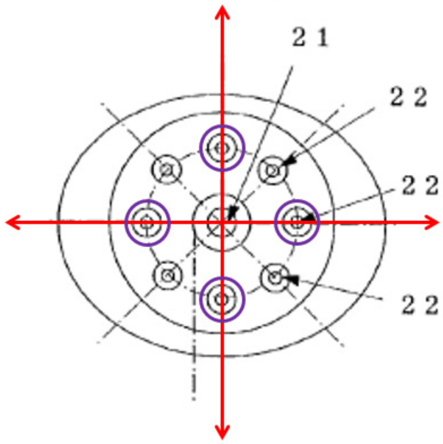
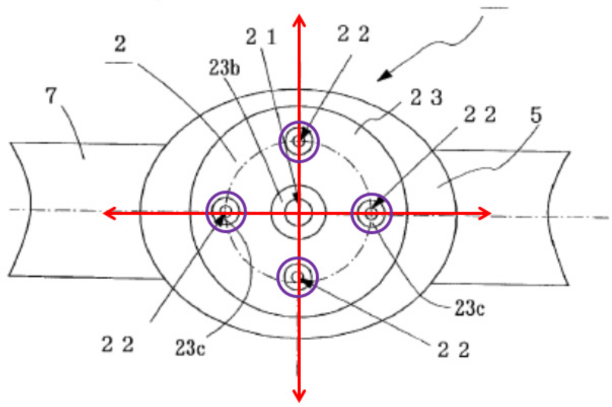


FIG. 1 (a)

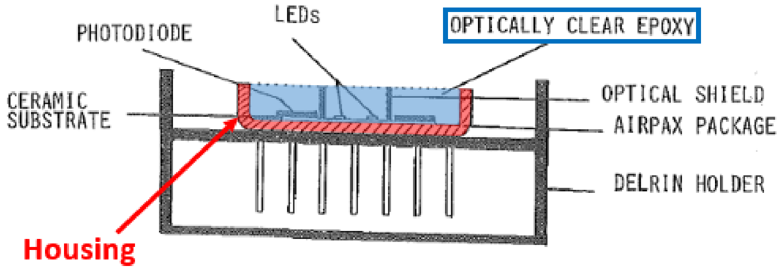


APPLE-1006, FIGS. 4(a) and 1(a)

171. Indeed, a POSITA would have considered using different numbers of spaced-apart detectors, namely 4 or 8, to be obvious and a routine and conventional design choice. APPLE-1006, [0032]. Relying on more or fewer detectors based on particular design requirements, as evidenced by Mendelson-1988 and Aizawa, was common practice well before the Critical Date, and there was nothing new or inventive about this aspect. *Id.*

[1d] the housing including a protruding light permeable cover.

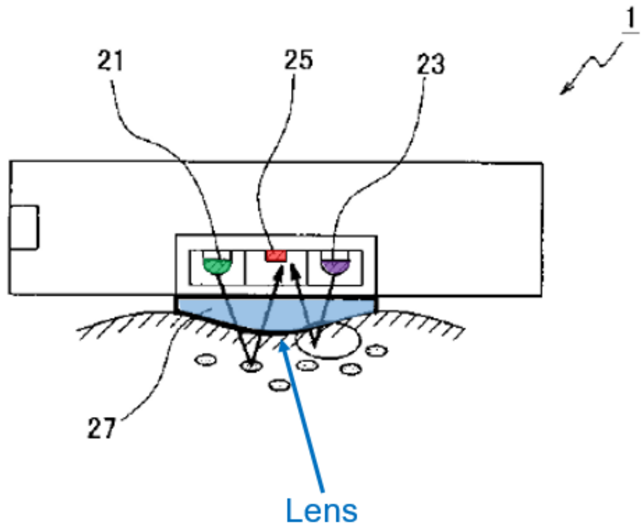
172. As shown below, Mendelson-1988 teaches encapsulating its emitters and detectors, which are within the housing (red), with an optically clear epoxy layer (blue). APPLE-1015, 168. This epoxy layer, therefore, corresponds to a light permeable cover that is arranged above the housing and covers the detectors. *Id.*



APPLE-1015, FIG. 2(b)

173. However, beyond Mendelson-1988's disclosure that this cover is made from "optically clear epoxy," Mendelson-1988 does not provide further details. Among other things, the precise shape of this layer, for instance whether it's completely flat or slightly curved, is not mentioned. It's also not mentioned whether this epoxy layer protrudes relative to the housing to, for instance, protect the user's skin from coming in direct contact with any sharp edges of the housing. Yet a POSITA would have recognized that the shape of the epoxy layer may be formed as needed to help further Mendelson'1988's goal of improving detection efficiency. APPLE-1015, 168, 173.

174. Indeed, as I described above, Inokawa teaches a similarly configured pulse sensor as in Mendelson-1988 but one in which a lens is positioned over the detectors to "increase the light-gathering ability of the LED as well as to protect the LED or [detector]." APPLE-1008, [0015], [0058].

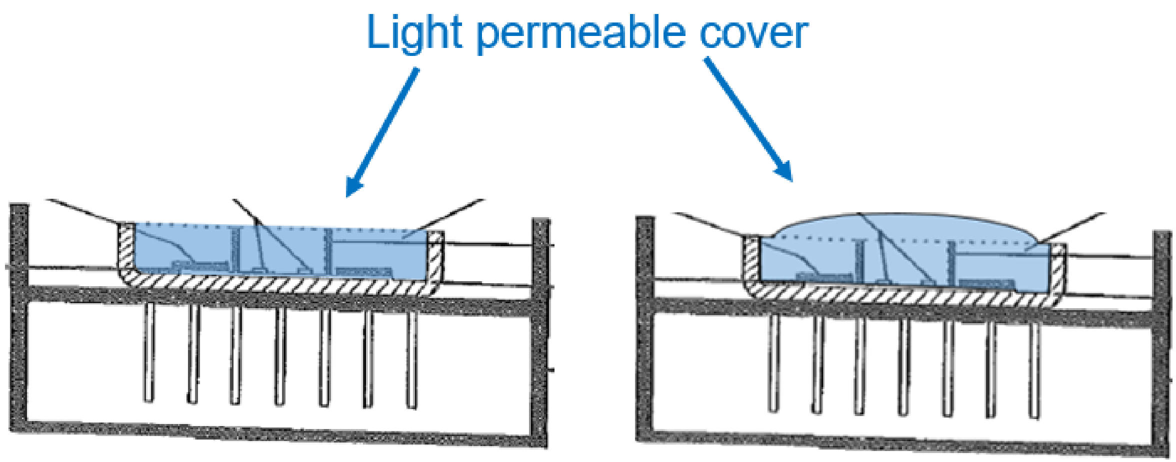


APPLE-1008, FIG. 2

175. Accordingly, a POSITA would have been motivated to incorporate the lens of Inokawa into to cover of Mendelson-1988 in order to increase the light collection efficiency. A POSITA would have been particularly interested in making such a modification because Mendelson-1988 shares a similar goal of maximizing "reflectance photoplethysmographic signals." APPLE-1015, 173. The lens of Inokawa provides precisely this benefit to Mendelson'1988's device by providing a protective cover that further refracts and concentrates the incoming light beams to thereby enhance the light collection efficiency and, by extension, the signal to noise ratio. APPLE-1008, [0015], [0058].

176. Indeed, as illustrated below, the device resulting from this combination of Mendelson-1988 and Inokawa would have modified the flat epoxy cover (left) with

a curved one as per Inokawa (right) to thereby “increase the light-gathering ability.” APPLE-1008, [0015].

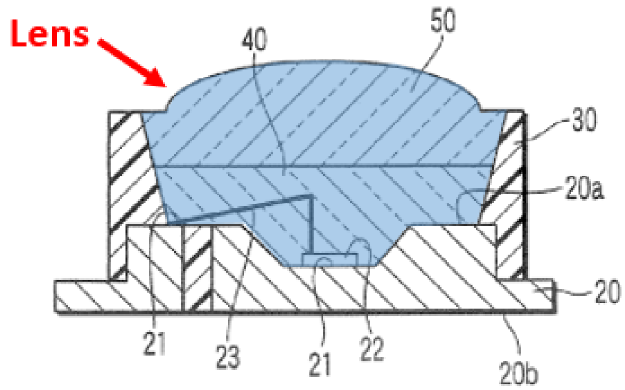


APPLE-1015, FIG. 2(B)

177. A POSITA would have understood how to implement Inokawa’s lens-based cover in Mendelson-1988 with a reasonable expectation of success based, among other things, on the significant overlap between these two references. Indeed, the above-described modification would require only routine knowledge of sensor design and assembly, which were well within the skill of a POSITA prior to the Critical Date.

178. Moreover, a POSITA would have easily understood how to modify the epoxy layer of Mendelson-1988 to achieve the desired shape. Indeed, Nishikawa, shown below, teaches that a clear epoxy layer as in Mendelson-1988 can be molded into a lens. APPLE-1023, [0022], [0032], [0035].

FIG. 6

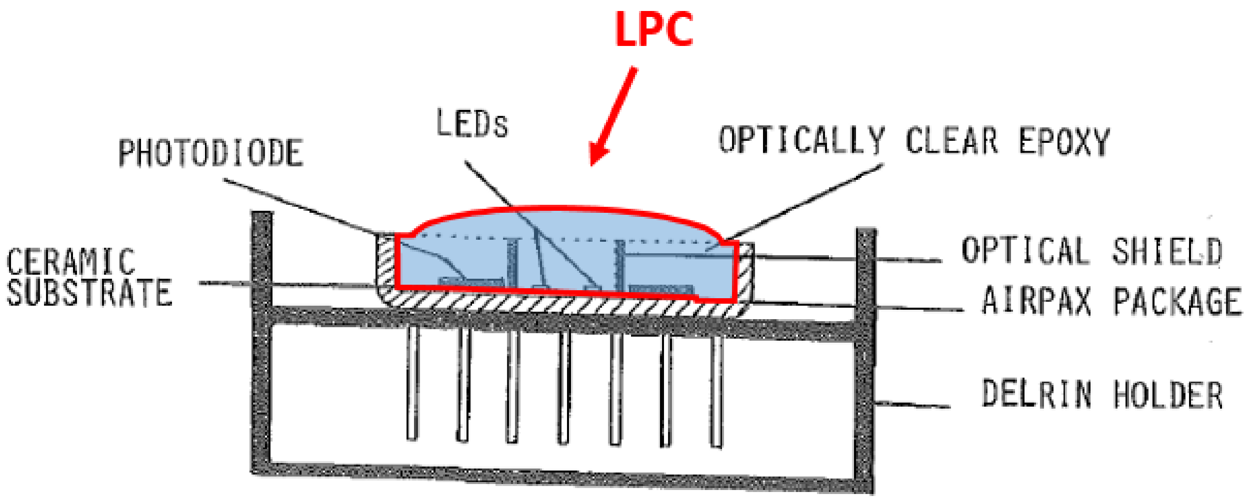


APPLE-1023, FIG. 6

179. Notably, both the optical encapsulation layer of Mendelson-1988 and the lens layer of Nishikawa are made from the same material, optically clear epoxy, and thus the interface between the encapsulation portion and the lens portion will not adversely affect the optical performance of the modified system. APPLE-1023, [0037]. Thus, to help achieve Mendelson-1988's and Inokawa's shared goal of improving light collection efficiency, a POSITA would have been motivated and able to modify Mendelson-1988's light permeable cover to have a lens structure as per Inokawa with a reasonable expectation of success.

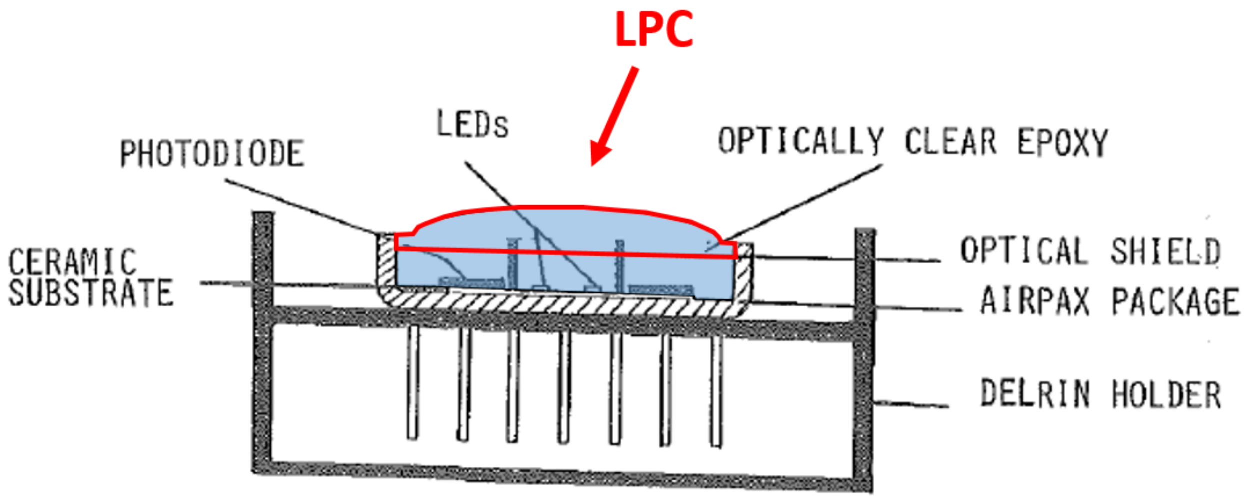
180. Here, I note that the claimed light permeable cover ("LPC") may be mapped in two different ways to the Mendelson-1988's epoxy layer as modified by Inokawa. <u>First</u>, the entire combined epoxy structure—*i.e.*, the sealing portion and the lens portion—may be viewed to be the LPC, as shown below. The LPC as described in the '708 patent, for example with regard to FIG. 14D, appears to

envision a similar two-part structure comprising a flat cover portion and a protruded lens portion. APPLE-1001, FIG. 14D.



APPLE-1015, FIG. 2(B)

181. Second, only the top lens portion, which lies above the underlying sealing portion, may be viewed to be the LPC having a protrusion. In forming this two-part structure, a POSITA would have been able to use the top portion of the housing (indicated below in purple), as in Nishikawa, to help form the LPC portion on top of the sealing portion. APPLE-1023, [0034]-[0038], FIGS. 5-6.

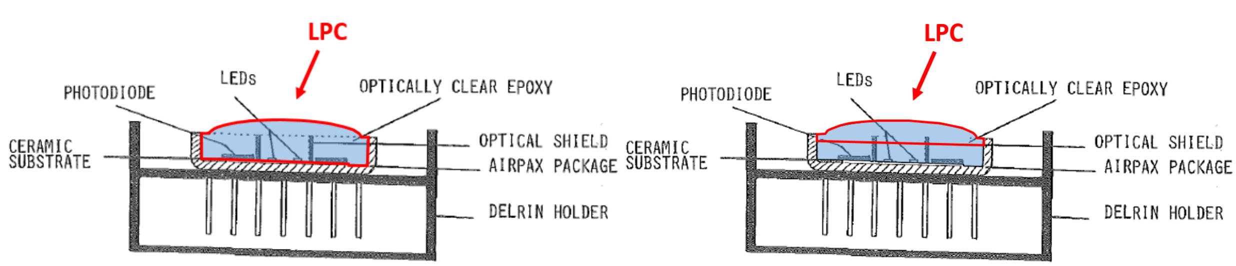


APPLE-1015, FIG. 2(B)

B. Claim 2

[2]: "The noninvasive optical physiological sensing system of claim 1, wherein the protruding light permeable cover is joined to the housing along the raised edge portion of the housing, and wherein the protruding light permeable cover and the housing together hermetically seal the at least four detectors."

182. As explained above with respect to element [1d] of Ground 2A and shown below, the modified LPC in the Mendelson-1988-Inokoawa combination, under either mapping, completely encapsulates and seals the detectors.



APPLE-1015, FIG. 2(B)